

## Part III — Building Planning and Construction for Single- and Two-Family Dwellings

### CHAPTER 53

## BUILDING PLANNING FOR SINGLE- AND TWO-FAMILY DWELLINGS

### SECTION 5301 DESIGN CRITERIA

**5301.1 Design.** Buildings and structures, and all parts thereof, shall be constructed to safely support all loads, including dead loads, live loads, roof loads, flood loads, snow loads, wind loads as prescribed by this code. The construction of buildings and structures shall result in a system that provides a complete load path capable of transferring all loads from their point of origin through the load-resisting elements to the foundation.

**5301.1.1 Alternative provisions.** *As an alternative to the requirements in Section 5301.1 the following standards are permitted subject to the limitations of this code and the limitations therein. In lieu of prescriptive compliance, where engineered design is used in conjunction with these standards the engineered design shall be performed by a Massachusetts-registered professional engineer or architect, employ an appropriate engineering rationale consistent with the standards below and utilize the wind and snow loads set forth in this code.*

1. American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual* (WFCM).
2. American Iron and Steel Institute (AISI), *Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings* (COFS/PM).

*Note that seismic design requirements are not applicable to one- and two-family detached dwellings.*

**5301.1.2 Construction systems.** The requirements of this code are based on platform and balloon-frame construction for light-frame buildings. The requirements for concrete and masonry buildings are based on a balloon framing system. Other framing systems must have equivalent detailing to ensure force transfer, continuity and compatible deformations.

**5301.1.3 Engineered design.** *When a building of otherwise conventional construction contains structural elements exceeding the limits of Section 5301 or otherwise, not conforming to this code, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the perfor-*

*mance of the conventional framed system. Engineered design shall be provided by a Massachusetts-registered professional engineer or architect and shall utilize the wind and snow loads set forth in this code.*

**5301.2 Climatic and geographic design criteria.** Buildings shall be constructed in accordance with the provisions of this code as limited by the provisions of this section; *also see Table 5301.2(1).*

**5301.2.1 Wind limitations.** Buildings and portions thereof shall be limited by wind speed, as defined in Table 5301.2(1), and construction methods in accordance with this code. Basic wind speeds shall be determined from Table 5301.2(4). Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of this section for each portion shall apply. Where loads for windows, skylights and exterior doors are not otherwise specified, the loads listed in Table 5301.2(2) adjusted for height and exposure per Table 5301.2(3), shall be used to determine design load performance requirements for windows and doors.

**5301.2.1.1 Design criteria.** Construction in regions where the basic wind speeds from Table 5301.2(4) equal or exceed 110 miles per hour (177.1 km/h) shall be designed in accordance with one of the following:

1. American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual for One- and Two-Family Dwellings* (WFCM); or
2. *Southern Building Code Congress International Standard for Hurricane Resistant Residential Construction* (SSTD 10); or
3. *Minimum Design Loads for Buildings and Other Structures* (ASCE-7); or
4. American Iron and Steel Institute (AISI), *Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings* (COFS/PM).
5. Concrete construction shall be designed in accordance with the provisions of this code.

**5301.2.1.2 Internal pressure.** Windows in buildings located in wind borne debris regions shall have glazed openings protected from windborne debris or the building shall be designed as a partially enclosed building in

**TABLE 5301.2(1)**  
**MASSACHUSETTS CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA**

GROUND SNOW LOAD	WIND SPEED <sup>a</sup> (mph)	SEISMIC DESIGN CATEGORY <sup>s</sup> (One- and Two- Family Detached Dwellings-only)	SUBJECT TO DAMAGE FROM			WINTER DESIGN TEMP <sup>i</sup>	ICE SHIELD UNDERLAYMENT REQUIRED <sup>j</sup>	FLOOD HAZARD <sup>h</sup>	AIR FREEZING INDEX <sup>i</sup>	MEAN ANNUAL TEMP <sup>a</sup>
			Weathering <sup>a</sup>	Frost Line Depth <sup>b</sup>	Termite <sup>e</sup>	Decay <sup>d</sup>				
Table 5301.2(5)	Table 5301.2(4)	N/A	Figure 5301.2(3)	4 ft. Minimum unless en- gineered data shows otherwise	Figure 5301.2(6)	Figure 5301.2(7)	As required by the exterior roof covering manufacturer; roof pitch and local climate must also be considered	Refer to the applicable Flood Insurance Rate Map (FIRM)	Only utilized in the design and construction of frost-protected shallow foundations	Only utilized in the design and construction of frost-protected shallow foundations

For SI: 1 foot = 304.8 mm.

- Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The weathering index ("negligible," "moderate" or "severe") shall be determined from the Weathering Probability Map [Figure 5301.2(3)]. The grade of masonry units shall be determined from ASTM C 34, C 55, C 62, C 73, C 90, C 129, C 145, C 216 or C 652, as applicable.
- The frost line depth shall be a minimum of 4 feet in Massachusetts unless engineering data demonstrates that the frost line depth is less than or greater than 4 feet. Under no circumstances will permanent foundation systems, required to be protected from frost be allowed set at less than 4 feet without engineering design ensuring foundation frost protection.
- Site-specific termite conditions should be determined when possible, otherwise Figure 5301.2(6) shall be utilized.
- Typically "slight" to "moderate."
- The basic wind speed shall be determined from Table 5301.2(4) for the specific city or town where construction is intended.
- See Appendix 780 CMR 120.13.2.1.
- Seismic design is not required for one- and two-family detached dwellings.
- The community Flood Insurance Rate Map (FIRM) shall be utilized to establish the flood hazard.
- The requirements of the manufacturer of the exterior roof covering shall be followed with regard to ice shield underlayment; likewise roof pitch and local climate must be considered.
- Only utilized when one is designing a frost-protected shallow foundation. When applicable, refer to the "100-year return period air freezing index" from Figure 5403.3(2) and for further clarification view the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°Fahrenheit)" at [www.ncdc.noaa.gov/fpsf.html](http://www.ncdc.noaa.gov/fpsf.html).
- Only utilized when one is designing a frost-protected shallow foundation. When applicable, refer to the "100-year return period air freezing index" from Figure 5403.3(2) and for further clarification view the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°Fahrenheit)" at [www.ncdc.noaa.gov/fpsf.html](http://www.ncdc.noaa.gov/fpsf.html).

**TABLE 5301.2(2)**  
**COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN**  
**ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (psf)**

	ZONE	EFFECTIVE WIND AREA (feet <sup>2</sup> )	BASIC WIND SPEED (mph—3-second gust)																							
			85		90		100		105		110		120		125		130		140		145		150		170	
Roof > 0 to 10 degrees	1	10	10.0	-13.0	10.0	-14.6	10.0	-18.0	10.0	-19.8	10.0	-21.8	10.5	-25.9	11.4	-28.1	12.4	-30.4	14.3	-35.3	15.4	-37.8	16.5	-40.5	21.1	-52.0
	1	20	10.0	-12.7	10.0	-14.2	10.0	-17.5	10.0	-19.3	10.0	-21.2	10.0	-25.2	10.7	-27.4	11.6	-29.6	13.4	-34.4	14.4	-36.9	15.4	-39.4	19.8	-50.7
	1	50	10.0	-12.2	10.0	-13.7	10.0	-16.9	10.0	-18.7	10.0	-20.5	10.0	-24.4	10.0	-26.4	10.6	-28.6	12.3	-33.2	13.1	-35.6	14.1	-38.1	18.1	-48.9
	1	100	10.0	-11.9	10.0	-13.3	10.0	-18.5	10.0	-18.2	10.0	-19.9	10.0	-23.7	10.0	-25.7	10.0	-27.8	11.4	-32.3	12.2	-34.6	13.0	-37.0	16.7	-47.6
	2	10	10.0	-21.8	10.0	-24.4	10.0	-30.2	10.0	-33.3	10.0	-36.5	10.5	-43.5	11.4	-47.2	12.4	-51.0	14.3	-59.2	15.4	-63.5	16.5	-67.9	21.1	-87.2
	2	20	10.0	-19.5	10.0	-21.8	10.0	-27.0	10.0	-29.7	10.0	-32.6	10.0	-38.8	10.7	-42.1	11.6	-45.6	13.4	-52.9	14.4	-56.7	15.4	-60.7	19.8	-78.0
	2	50	10.0	-16.4	10.0	-18.4	10.0	-22.7	10.0	-25.1	10.0	-27.5	10.0	-32.7	10.0	-35.5	10.6	-38.4	12.3	-44.5	13.1	-47.8	14.1	-51.1	18.1	-65.7
	2	100	10.0	-14.1	10.0	-15.8	10.0	-19.5	10.0	-21.5	10.0	-23.6	10.0	-28.1	10.0	-30.5	10.0	-33.0	11.4	-38.2	12.2	-41.0	13.0	-43.9	16.7	-56.4
	3	10	10.0	-32.8	10.0	-36.8	10.0	-45.4	10.0	-50.1	10.0	-55.0	10.5	-65.4	11.4	-71.0	12.4	-76.8	14.3	-89.0	15.4	-95.5	16.5	-102.2	21.1	-131.3
	3	20	10.0	-27.2	10.0	-30.5	10.0	-37.6	10.0	-41.5	10.0	-45.5	10.0	-54.2	10.7	-58.8	11.6	-63.6	13.4	-73.8	14.4	-79.1	15.4	-84.7	19.8	-108.7
	3	50	10.0	-19.7	10.0	-22.1	10.0	-27.3	10.0	-30.1	10.0	-33.1	10.0	-39.3	10.0	-42.7	10.6	-46.2	12.3	-53.5	13.1	-57.4	14.1	-61.5	18.1	-78.9
	3	100	10.0	-14.1	10.0	-15.8	10.0	-19.5	10.0	-21.5	10.0	-23.6	10.0	-28.1	10.0	-30.5	10.0	-33.0	11.4	-38.2	12.2	-41.0	13.0	-43.9	16.7	-56.4
Roof > 10 to 30 degrees	1	10	10.0	-11.9	10.0	-13.3	10.4	-16.5	11.4	-18.2	12.5	-19.9	14.9	-23.7	16.2	-25.7	17.5	-27.8	20.3	-32.3	21.8	-34.6	23.3	-37.0	30.0	-47.6
	1	20	10.0	-11.6	10.0	-13.0	10.0	-16.0	10.4	-17.6	11.4	-19.4	13.6	-23.0	14.8	-25.0	16.0	-27.0	18.5	-31.4	19.9	-33.7	21.3	-36.0	27.3	-46.3
	1	50	10.0	-11.1	10.0	-12.5	10.0	-15.4	10.0	-17.0	10.0	-18.6	11.9	-22.2	12.9	-24.1	13.9	-26.0	16.1	-30.2	17.3	-32.4	18.5	-34.6	23.8	-44.5
	1	100	10.0	-10.8	10.0	-12.1	10.0	-14.9	10.0	-16.5	10.0	-18.1	10.5	-21.5	11.4	-23.3	12.4	-25.2	14.3	-29.3	15.4	-31.4	16.5	-33.6	21.1	-43.2
	2	10	10.0	-25.1	10.0	-28.2	10.4	-34.8	11.4	-38.3	12.5	-42.1	14.9	-50.1	16.2	-54.3	17.5	-58.7	20.3	-68.1	21.8	-73.1	23.3	-78.2	30.0	-100.5
	2	20	10.0	-22.8	10.0	-25.6	10.0	-31.5	10.4	-34.8	11.4	-38.2	13.6	-45.4	14.8	-49.3	16.0	-53.3	18.5	-61.8	19.9	-66.3	21.3	-71.0	27.3	-91.2
	2	50	10.0	-19.7	10.0	-22.1	10.0	-27.3	10.0	-30.1	10.0	-33.0	11.9	-39.3	12.9	-42.7	13.9	-46.1	16.1	-53.5	17.3	-57.4	18.5	-61.4	23.8	-78.9
	2	100	10.0	-17.4	10.0	-19.5	10.0	-24.1	10.0	-26.6	10.0	-29.1	10.5	-34.7	11.4	-37.6	12.4	-40.7	14.3	-47.2	15.4	-50.6	16.5	-54.2	21.1	-69.6
	3	10	10.0	-25.1	10.0	-28.2	10.4	-34.8	11.4	-38.3	12.5	-42.1	14.9	-50.1	16.2	-54.3	17.5	-58.7	20.3	-68.1	21.8	-73.1	23.3	-78.2	30.0	-100.5
	3	20	10.0	-22.8	10.0	-25.6	10.0	-31.5	10.4	-34.8	11.4	-38.2	13.6	-45.4	14.8	-49.3	16.0	-53.3	18.5	-61.8	19.9	-66.3	21.3	-71.0	27.3	-91.2
	3	50	10.0	-19.7	10.0	-22.1	10.0	-27.3	10.0	-30.1	10.0	-33.0	11.9	-39.3	12.9	-42.7	13.9	-46.1	16.1	-53.5	17.3	-57.4	18.5	-61.4	23.8	-78.9
	3	100	10.0	-17.4	10.0	-19.5	10.0	-24.1	10.0	-26.6	10.0	-29.1	10.5	-34.7	11.4	-37.6	12.4	-40.7	14.3	-47.2	15.4	-50.6	16.5	-54.2	21.1	-69.6
Roof > 30 to 45 degrees	1	10	11.9	-13.0	13.3	-14.6	16.5	-18.0	18.2	-19.8	19.9	-21.8	23.7	-25.9	25.7	-28.1	27.8	-30.4	32.3	-35.3	34.6	-37.8	37.0	-40.5	47.6	-52.0
	1	20	11.6	-12.3	13.0	-13.8	16.0	-17.1	17.6	-18.8	19.4	-20.7	23.0	-24.6	25.0	-26.7	27.0	-28.9	31.4	-33.5	33.7	-35.9	36.0	-38.4	46.3	-49.3
	1	50	11.1	-11.5	12.5	-12.8	15.4	-15.9	17.0	-17.5	18.6	-19.2	22.2	-22.8	24.1	-24.8	26.0	-25.8	30.2	-31.1	32.4	-33.3	34.6	-35.7	44.5	-45.8
	1	100	10.8	-10.8	12.1	-12.1	14.9	-14.9	16.5	-16.5	18.1	-18.1	21.5	-21.5	23.3	-23.3	25.2	-25.2	29.3	-29.3	31.4	-31.4	33.6	-33.6	43.2	-43.2
	2	10	11.9	-15.2	13.3	-17.0	16.5	-21.0	18.2	-23.2	19.9	-25.5	23.7	-30.3	25.7	-32.9	27.8	-35.6	32.3	-41.2	34.6	-44.2	37.0	-47.3	47.6	-60.8
	2	20	11.6	-14.5	13.0	-16.3	16.0	-20.1	17.6	-22.2	19.4	-24.3	23.0	-29.0	25.0	-31.4	27.0	-34.0	31.4	-39.4	33.7	-42.3	36.0	-45.3	46.3	-58.1
	2	50	11.1	-13.7	12.5	-15.3	15.4	-18.9	17.0	-20.8	18.6	-22.9	22.2	-27.2	24.1	-29.5	26.0	-32.0	30.2	-37.1	32.4	-39.8	34.6	-42.5	44.5	-54.6
	2	100	10.8	-13.0	12.1	-14.6	14.9	-18.0	16.5	-19.8	18.1	-21.8	21.5	-25.9	23.3	-28.1	25.2	-30.4	29.3	-35.3	31.4	-37.8	33.6	-40.5	43.2	-52.0
	3	10	11.9	-15.2	13.3	-17.0	16.5	-21.0	18.2	-23.2	19.9	-25.5	23.7	-30.3	25.7	-32.9	27.8	-35.6	32.3	-41.2	34.6	-44.2	37.0	-47.3	47.6	-60.8
	3	20	11.6	-14.5	13.0	-16.3	16.0	-20.1	17.6	-22.2	19.4	-24.3	23.0	-29.0	25.0	-31.4	27.0	-34.0	31.4	-39.4	33.7	-42.3	36.0	-45.3	46.3	-58.1
	3	50	11.1	-13.7	12.5	-15.3	15.4	-18.9	17.0	-20.8	18.6	-22.9	22.2	-27.2	24.1	-29.5	26.0	-32.0	30.2	-37.1	32.4	-39.8	34.6	-42.5	44.5	-54.5
	3	100	10.8	-13.0	12.1	-14.6	14.9	-18.0	16.5	-19.8	18.1	-21.8	21.5	-25.9	23.3	-28.1	25.2	-30.4	29.3	-35.3	31.4	-37.8	33.6	-40.5	43.2	-52.0
Wall	4	10	13.0	-14.1	14.6	-15.8	18.0	-19.5	19.8	-21.5	21.8	-23.6	25.9	-28.1	28.1	-30.5	30.4	-33.0	35.3	-38.2	37.8	-41.0	40.5	-43.9	52.0	-56.4
	4	20	12.4	-13.5	13.9	-15.1	17.2	-18.7	18.9	-20.6	20.8	-22.6	24.7	-26.9	26.8	-29.2	29.0	-31.6	33.7	-36.7	36.1	-39.3	38.7	-42.1	49.6	-54.1
	4	50	11.6	-12.7	13.0	-14.3	16.1	-17.6	17.8	-19.4	19.5	-21.3	23.2	-25.4	25.2	-27.5	27.2	-29.8	31.6	-34.6	33.9	-37.1	36.2	-39.7	46.6	-51.0
	4	100	11.1	-12.2	12.4	-13.6	15.3	-16.8	16.9	-18.5	18.5	-20.4	22.0	-24.2	23.9	-26.3	25.9	-28.4	30.0	-33.0	32.2	-35.4	34.4	-37.8	44.2	-48.6
	5	10	13.0	-17.4	14.6	-19.5	18.0	-24.1	19.8	-26.6	21.8	-29.1	25.9	-34.7	28.1	-37.6	30.4	-40.7	35.3	-47.2	37.8	-50.6	40.5	-54.2	52.0	-69.6
	5	20	12.4	-16.2	13.9	-18.2	17.2	-22.5	18.9	-24.8	20.8	-27.2	24.7	-32.4	26.8	-35.1	29.0	-38.0	33.7	-44.0	36.1	-47.2	38.7	-50.5	49.6	-64.9
	5	50	11.6	-14.7	13.0	-16.5	16.1	-20.3	17.8	-22.4	19.5	-24.6	23.2	-29.3	25.2	-31.8	27.2	-34.3	31.6	-39.8	33.9	-42.7	36.2	-45.7	46.6	-58.7
	5	100	11.1	-13.5	12.4	-15.1	15.3	-18.7	16.9	-20.6	18.5	-22.6	22.0	-26.9	23.9	-29.2	25.9	-31.6	30.0	-36.7	32.2	-39.3	34.4	-42.1	44.2	-54.1

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>, 1 mile per hour = 1.609 km/h.

**NOTES:** For effective areas between those given above the load may be interpolated, otherwise use the load associated with the lower effective area.

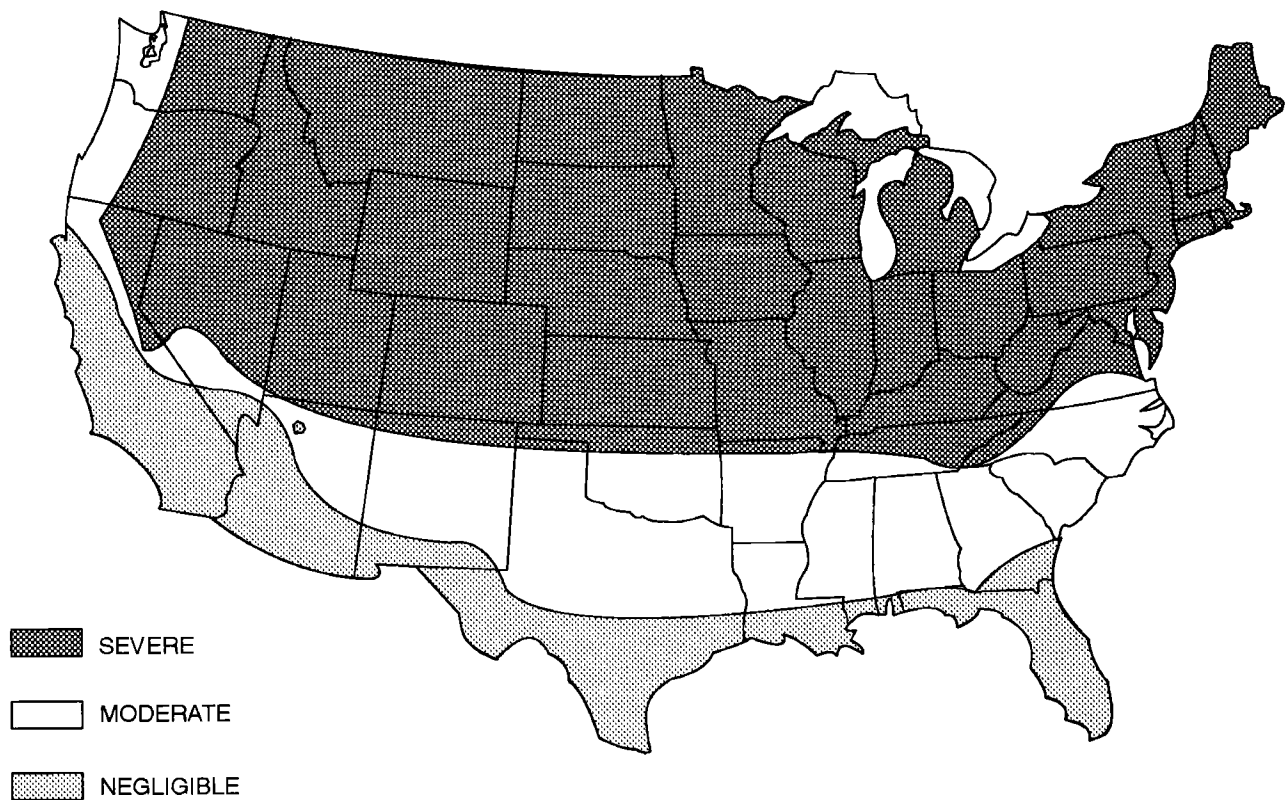
Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table 5301.2(3).

See Figure 5301.2(8) for location of zones.

Plus and minus signs signify pressures acting toward and away from the building surfaces.

**TABLE 5301.2(3)**  
**HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR TABLE R301.2(2)**

MEAN ROOF HEIGHT	EXPOSURE		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87



- a. Alaska and Hawaii are classified as severe and negligible, respectively.
- b. Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by region classification. A severe classification is where weather conditions result in significant snowfall combined with extended periods during which there is little or no natural thawing causing deicing salts to be used extensively.

**[B] FIGURE 5301.2(3)**  
**WEATHERING PROBABILITY MAP FOR CONCRETE**

**TABLE 5301.2(4)**  
**MASSACHUSETTS BASIC WIND SPEEDS**

<b>CITIES AND TOWNS HAVING A BASIC WIND SPEED OF 90 MPH</b>		
Adams	Lanesborough	Richmond
Alford	Lee	Sandisfield
Becket	Lenox	Savoy
Cheshire	Monterey	Sheffield
Clarksburg	Mount Washington	Stockbridge
Dalton	New Ashford	Tyringham
Egremont	New Marlborough	Washington
Florida	North Adams	West Stockbridge
Great Barrington	Otis	Williamstown
Hancock	Peru	Windsor
Hinsdale	Pittsfield	
<b>CITIES AND TOWNS HAVING A BASIC WIND SPEED OF 100 MPH</b>		
Acton	Groton	Philipston
Agawam	Hadley	Plainfield
Amherst	Hampden	Plainville
Ashburnham	Hardwick	Princeton
Ashby	Harvard	Rowe
Ashfield	Hatfield	Royalston
Ashland	Hawley	Russell
Athol	Heath	Rutland
Auburn	Holden	Sharon
Avon	Holliston	Shelburne
Ayer	Holland	Sherborn
Barre	Holyoke	Shirley
Bedford	Hopedale	Shrewsbury
Belchertown	Hopkinton	Shutesbury
Bellingham	Hubbardston	Southampton
Berlin	Hudson	Southborough
Bernardston	Huntington	Southbridge
Billerica	Lancaster	South Hadley
Blackstone	Leicester	Southwick
Blandford	Leominster	Spencer
Bolton	Leverett	Springfield
Boylston	Leyden	Sterling
Boxborough	Lincoln	Stoughton
Brimfield	Littleton	Stow
Brookfield	Longmeadow	Sturbridge
Buckland	Lowell	Sudbury
Canton	Ludlow	Sunderland
Carlisle	Lunenburg	Sutton
Charlemont	Marlborough	Templeton
Charlton	Maynard	Tewksbury
Chelmsford	Medfield	Tolland
Chester	Medway	Townsend
Chesterfield	Mendon	Tyngsborough
Chicopee	Middlefield	Upton
Clinton	Milford	Uxbridge
Colrain	Millbury	Wales
Concord	Millis	Walpole
Conway	Millville	Ware
Cummington	Monroe	Warren
Dedham	Monson	Warwick
Deerfield	Montague	Wayland
Douglas	Montgomery	Webster
Dover	Natick	Wellesley
Dracut	Needham	Wendell
Dudley	New Braintree	Westborough
Dunstable	New Salem	West Boylston
East Brookfield	Norfolk	West Brookfield
Easthampton	Northbridge	Westfield
East Longmeadow	Northborough	Westford
Erving	North Brookfield	Westhampton
Fitchburg	Northfield	Westminster

<b>CITIES AND TOWNS HAVING A BASIC WIND SPEED OF 100 MPH</b>		
Foxborough	Northampton	Weston
Framingham	Norwood	West Springfield
Franklin	Oakham	Westwood
Gardner	Orange	Whately
Gill	Oxford	Winchendon
Goshen	Palmer	Wilbraham
Grafton	Paxton	Williamsburg
Granby	Pelham	Worcester
Granville	Pepperell	Worthington
Greenfield	Petersham	Wrentham
<b>CITIES AND TOWNS HAVING A BASIC WIND SPEED OF 105 MPH</b>		
Arlington	Malden	Stoneham
Belmont	Medford	Wakefield
Boston	Melrose	Waltham
Braintree	Milton	Watertown
Brookline	Newton	Weymouth
Burlington	North Reading	Wilmington
Cambridge	Quincy	Winchester
Chelsea	Randolph	Winthrop
Everett	Reading	Woburn
Holbrook	Revere	
Lexington	Somerville	
<b>CITIES AND TOWNS HAVING A BASIC WIND SPEED OF 110 MPH (Portions of the North Shore)</b>		
Amesbury	Lawrence	Peabody
Andover	Lynn	Rockport
Beverly	Lynnfield	Rowley
Boxford	Manchester by the sea	Salem
Danvers	Marblehead	Salisbury
Essex	Merrimac	Saugus
Georgetown	Methuen	Swampscott
Gloucester	Middleton	Topsfield
Groveland	Nahant	Wenham
Hamilton	Newbury	West Newbury
Haverhill	Newburyport	
Ipswich	North Andover	
<b>CITIES AND TOWNS HAVING A BASIC WIND SPEED OF 110 MPH (Portions of the South Shore)</b>		
Abington	Halifax	Pembroke
Acushnet	Hanover	Plymouth
Attleboro	Hanson	Plympton
Berkley	Hingham	Raynham
Bridgewater	Hull	Rehoboth
Brockton	Kingston	Rochester
Carver	Lakeville	Rockland
Cohasset	Mansfield	Scituate
Dartmouth	Marion	Seekonk
Dighton	Marshfield	Somerset
Duxbury	Mattapoisett	Swansea
East Bridgewater	Middleboro	Taunton
Easton	New Bedford	Wareham
Fairhaven	North Attleborough	West Bridgewater
Fall River	Norton	Westport
Freetown	Norwell	Whitman
<b>CITIES AND TOWNS HAVING A BASIC WIND SPEED OF 120 MPH</b>		
Aquinnah	Edgartown	Provincetown
Barnstable	Falmouth	Sandwich
Bourne	Gosnold	Tisbury
Brewster	Harwich	Truro
Chatham	Mashpee	Wellfleet
Chilmark	Nantucket	West Tisbury
Dennis	Oak Bluffs	Yarmouth
Eastham	Orleans	

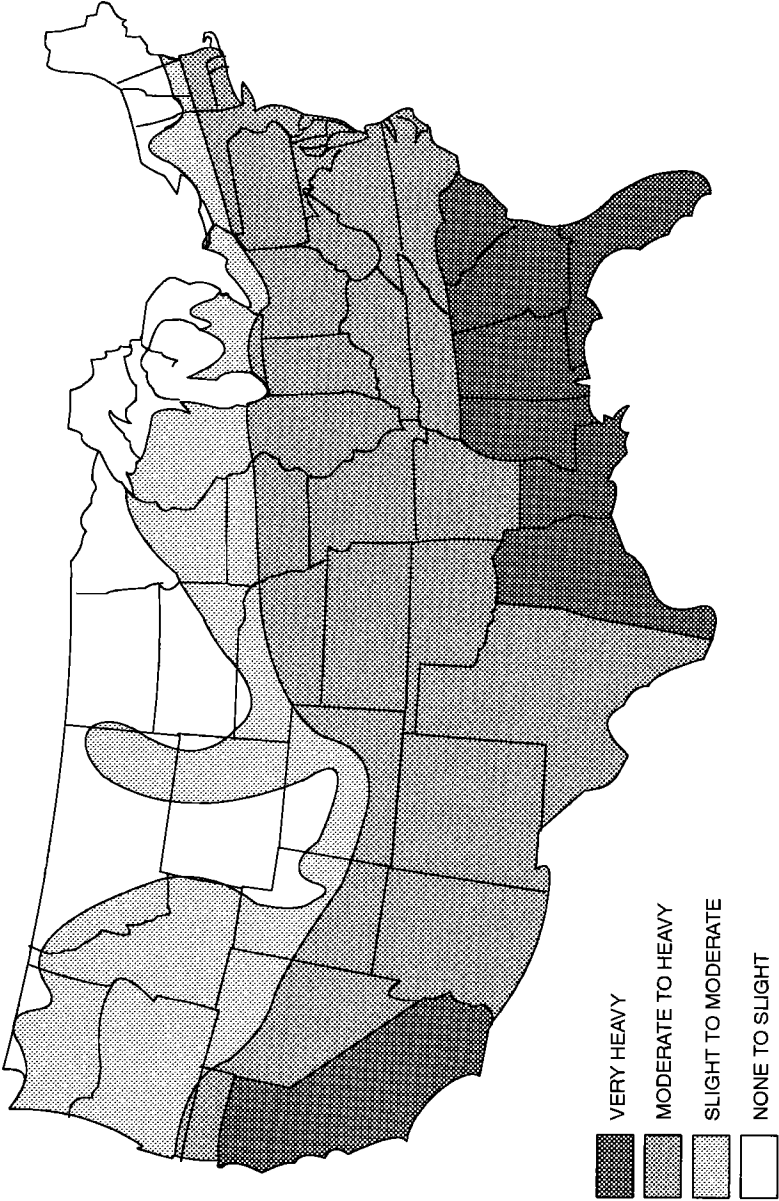
**TABLE 5301.01.2(5)  
MASSACHUSETTS GROUND SNOW LOADS**

<b>CITIES AND TOWNS HAVING A GROUND SNOW LOAD OF 35 PSF</b>		
Aquinnah	Edgartown	Provincetown
Barnstable	Falmouth	Sandwich
Bourne	Gosnold	Tisbury
Brewster	Harwich	Truro
Chatham	Mashpee	Wellfleet
Chilmark	Nantucket	West Tisbury
Dennis	Oak Bluffs	Yarmouth
Eastham	Orleans	
<b>CITIES AND TOWNS HAVING A GROUND SNOW LOAD OF 45 PSF</b>		
Abington	Hanover	Plymouth
Acushnet	Hanson	Plympton
Arlington	Hingham	Quincy
Belmont	Holbrook	Randolph
Beverly	Hull	Revere
Boston	Ipswich	Rochester
Braintree	Kingston	Rockland
Bridgewater	Lakeville	Rockport
Brockton	Lynn	Salem
Brookline	Lynnfield	Saugus
Cambridge	Malden	Scituate
Carver	Manchester By the Sea	Somerville
Chelsea	Marblehead	Stoneham
Cohasset	Marion	Swampscott
Danvers	Marshfield	Topsfield
Dartmouth	Mattapoisett	Wakefield
Duxbury	Medford	Wareham
East Bridgewater	Melrose	Watertown
Essex	Middleborough	Wenham
Everett	Middleton	West Bridgewater
Fairhaven	Milton	Westport
Fall River	Nahant	Weymouth
Freetown	New Bedford	Whitman
Gloucester	Norwell	Winthrop
Halifax	Peabody	
Hamilton	Pembroke	
<b>CITIES AND TOWNS HAVING A GROUND SNOW LOAD OF 55 PSF</b>		
Acton	Haverhill	Reading
Agawam	Holden	Rehoboth
Amesbury	Holland	Rowley
Amherst	Holliston	Rutland
Andover	Holyoke	Salisbury
Ashland	Hopedale	Seekonk
Attleboro	Hopkinton	Sharon
Auburn	Hudson	Sherborn
Avon	Lancaster	Shrewsbury
Barre	Lawrence	Somerset
Bedford	Leicester	Southampton
Belchertown	Lexington	Southborough
Bellingham	Lincoln	Southbridge
Berkley	Littleton	South Hadley
Berlin	Longmeadow	Southwick
Billerica	Lowell	Spencer
Blackstone	Ludlow	Springfield
Bolton	Mansfield	Sterling
Boxborough	Marlborough	Stoughton
Boxford	Maynard	Stow
Boylston	Medfield	Sturbridge
Brimfield	Medway	Sudbury
Brookfield	Mendon	Sutton
Burlington	Merrimac	Swansea

**CITIES AND TOWNS HAVING A GROUND SNOW LOAD OF 55 PSF**

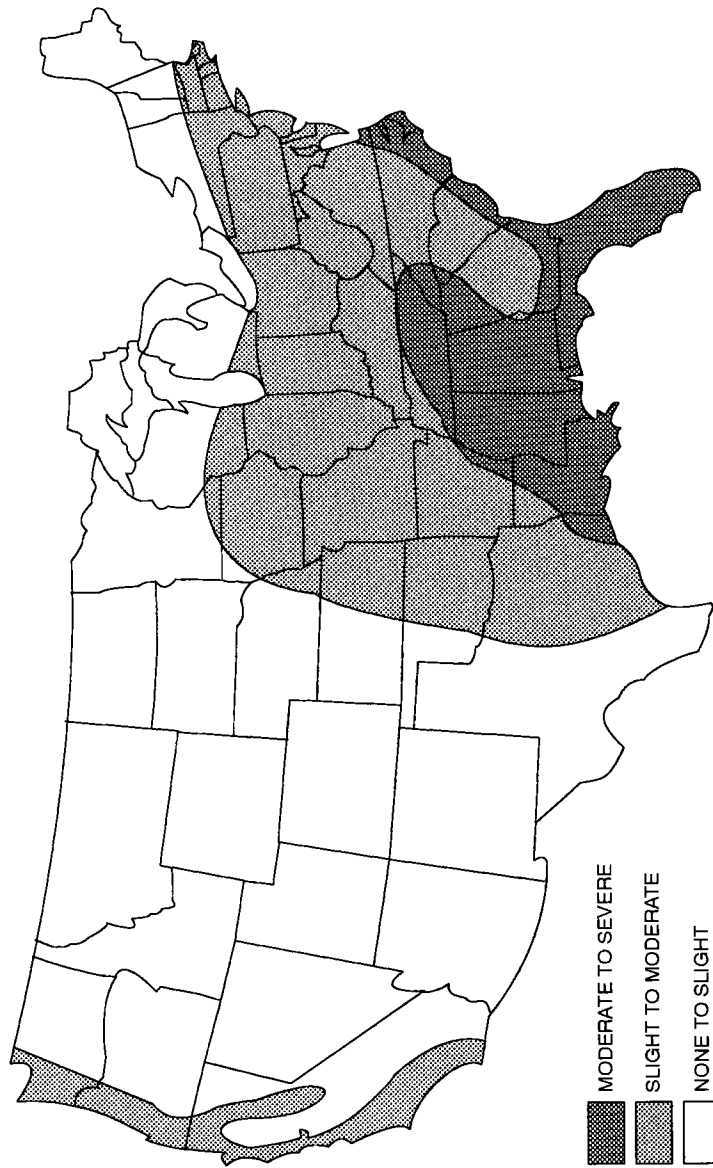
Canton	Methuen	Taunton
Carlisle	Milford	Tewksbury
Charlton	Millbury	Tyngsborough
Chelmsford	Millis	Upton
Chicopee	Millville	Uxbridge
Clinton	Monson	Wales
Concord	Natick	Walpole
Dedham	Needham	Waltham
Dighton	New Braintree	Ware
Douglas	Newbury	Warren
Dover	Newburyport	Wayland
Dracut	Newton	Webster
Dudley	Norfolk	Wellesley
East Brookfield	Northampton	Westborough
Easthampton	North Andover	West Boylston
East Longmeadow	North Attleborough	West Brookfield
Easton	Northborough	Westfield
Foxborough	Northbridge	Westford
Framingham	North Brookfield	West Newbury
Franklin	North Reading	Weston
Georgetown	Norton	West Springfield
Grafton	Norwood	Westwood
Granby	Oakham	Wilbraham
Groveland	Oxford	Wilmington
Hadley	Palmer	Winchester
Hampden	Paxton	Woburn
Hardwick	Pelham	Worcester
Harvard	Plainville	Wrentham
Hatfield	Raynham	
<b>CITIES AND TOWNS HAVING A GROUND SNOW LOAD OF 65 PSF</b>		
Adams	Groton	Plainfield
Alford	Hancock	Princeton
Ashburnham	Hawley	Richmond
Ashby	Heath	Rowe
Ashfield	Hinsdale	Royalston
Athol	Hubbardston	Russell
Ayer	Huntington	Sandisfield
Becket	Lanesborough	Savoy
Bernardston	Lee	Sheffield
Blandford	Lenox	Shelburne
Buckland	Leominster	Shirley
Charlemont	Leverett	Shutesbury
Cheshire	Leyden	Stockbridge
Chester	Lunenburg	Sunderland
Chesterfield	Middlefield	Templeton
Clarksburg	Monroe	Tolland
Colrain	Montague	Townsend
Conway	Monterey	Tyringham
Cummington	Montgomery	Warwick
Dalton	Mount Washington	Washington
Deerfield	New Ashford	Wendell
Dunstable	New Marlborough	Westhampton
Egremont	New Salem	Westminster
Erving	North Adams	West Stockbridge
Fitchburg	Northfield	Whately
Florida	Orange	Williamsburg
Gardner	Otis	Williamstown
Gill	Pepperell	Winchendon
Goshen	Peru	Windsor
Granville	Petersham	Worthington
Great Barrington	Philipston	
Greenfield	Pittsfield	

For SI: 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.



**NOTE:** Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

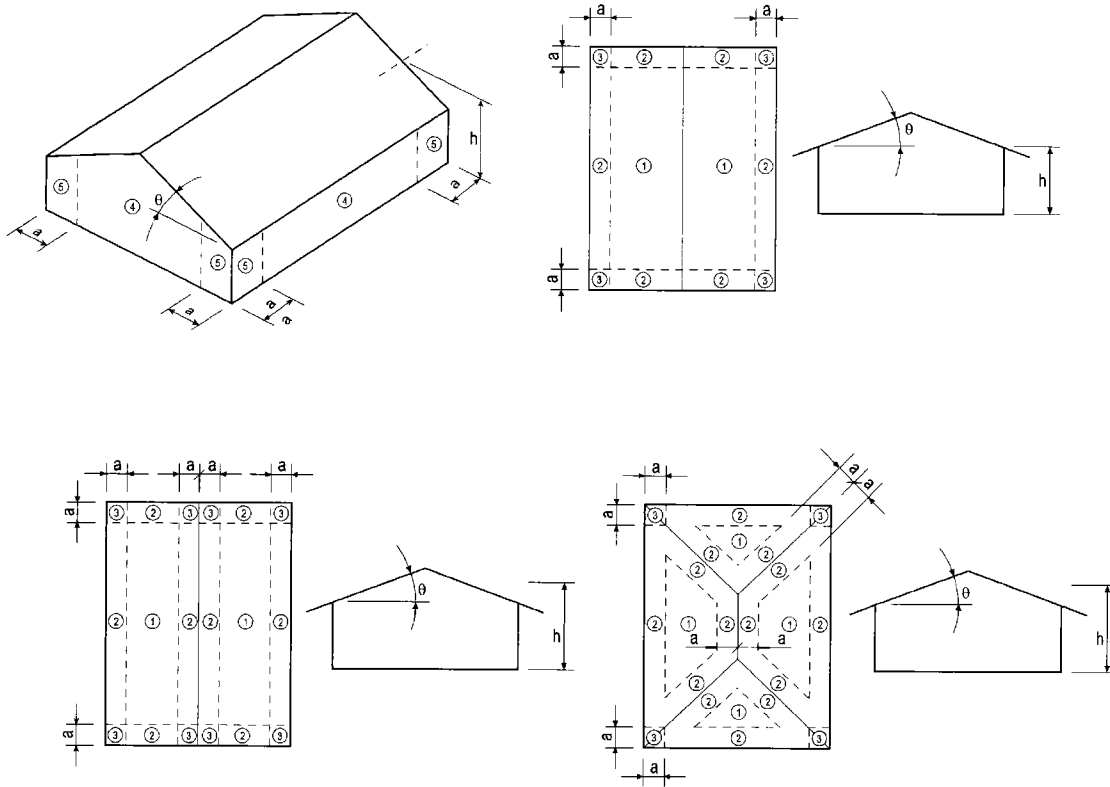
**FIGURE 5301.2(6)  
TERMITE INFESTATION PROBABILITY MAP**



NOTES: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

**FIGURE 5301.2(7)  
DECAY PROBABILITY MAP**





For SI: 1 foot = 304.8 mm, 1 degree = 0.009 rad.

NOTE:  $a = 4$  feet in all cases

**FIGURE 5301.2(8)**  
**COMPONENT AND CLADDING PRESSURE ZONES**

accordance with the *International Building Code but utilizing the wind loads set forth in this code*. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and of ASTM E 1886 referenced therein.

**Exception:** Wood structural panels with a minimum thickness of  $\frac{7}{16}$  inch (11.1 mm) and a maximum span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut to cover the glazed openings with attachment hardware provided. Attachments shall be provided in accordance with Table 5301.2.1.2 or shall be designed to resist the components and cladding loads determined in accordance with the provisions of the *International Building Code but utilizing the wind loads set forth in this chapter*.

**TABLE 5301.2.1.2**  
**WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE**  
**FOR WOOD STRUCTURAL PANELS<sup>a,b,c</sup>**

FASTENER TYPE	FASTENER SPACING		
	Panel span ≤ 4 foot	4 foot < panel span ≤ 6 foot	6 foot < panel span ≤ 8 foot
2 $\frac{1}{2}$ " #6 Wood screws	16"	12"	9"
2 $\frac{1}{2}$ " #8 Wood screws	16"	16"	12"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 0.454 kg,  
1 mile per hour = 1.609 km/h.

- This table is based on 130 mph wind speeds and a 33-foot mean roof height.
- Fasteners shall be installed at opposing ends of the wood structural panel.
- Where screws are attached to masonry or masonry/stucco, they shall be attached utilizing vibration-resistant anchors having a minimum ultimate withdrawal capacity of 490 pounds.

**5301.2.1.3 Wind speed conversion.** When referenced documents are based on fastest mile wind speeds, the three second gust wind velocities of **Table 5301.2(4)** shall be converted to fastest mile wind velocities using Table 5301.2.1.3.

**5301.2.1.4 Exposure category.** For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features. For any given wind direction, the exposure in which a specific building or other struc-

ture is sited shall be assessed as being one of the following categories:

- Exposure A.** Large city centers with at least 50 percent of the buildings having a height in excess of 70 feet (21 336 mm). Use of this exposure category shall be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least 0.5 mile (0.8 km) or 10 times the height of the building or other structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.
- Exposure B.** Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.
- Exposure C.** Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat open country, grasslands and shorelines in hurricane prone regions.
- Exposure D.** Flat, unobstructed areas exposed to wind flowing over open water (excluding shorelines in hurricane prone regions) for a distance of at least 1 mile (1.61 km). Shorelines in Exposure D include inland waterways, the Great Lakes and coastal areas of California, Oregon, Washington and Alaska. This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 1,500 feet (457 m) or 10 times the height of the building or structure, whichever is greater.

#### 5301.2.2 Seismic provisions. *Reserved.*

**5301.2.3 Snow loads.** Wood framed construction, cold-formed steel framed construction and masonry and concrete construction in regions with ground snow loads 70

**TABLE 5301.2.1.3**  
**EQUIVALENT BASIC WIND SPEEDS<sup>a</sup>**

3-second gust	85	90	100	105	110	120	125	130	140	145	150	160	170
Fastest mile	70	75	80	85	90	100	105	110	120	125	130	140	150

For SI: 1 mile per hour = 1.609 km/h.

- Linear interpolation is permitted.

psf (3.35 kN/m<sup>2</sup>) or less, shall be in accordance with Chapters 55, 56 and 58. Buildings in regions with ground snow loads greater than 70 psf (3.35 kN/m<sup>2</sup>) shall be designed in accordance with accepted engineering practice.

**5301.2.4 Floodplain construction.** Buildings and structures constructed in flood hazard areas (including A or V Zones) as established by *FEMA Flood Insurance Rate Maps* shall be designed and constructed in accordance with Section 5323.

**5301.3 Story height.** Buildings constructed in accordance with these provisions shall be limited to story heights of not more than the following:

1. For wood wall framing, the laterally unsupported bearing wall stud height permitted by Table 5602.3(5) plus a height of floor framing not to exceed sixteen inches.

**Exception:** For wood framed wall buildings with bracing in accordance with Table 5602.10.1, the wall stud clear height used to determine the maximum permitted story height may be increased to 12 feet without requiring an engineered design for the building wind force resisting systems provided that the length of bracing required by Table 5602.10.1 is increased by multiplying by a factor of 1.20. Wall studs are still subject to the requirements of this section.

2. For steel wall framing, a stud height of 10 feet, plus a height of floor framing not to exceed 16 inches.
3. For masonry walls, a maximum bearing wall clear height of 12 feet plus a height of floor framing not to exceed 16 inches.

**Exception:** An additional 8 feet is permitted for gable end walls.

4. For insulating concrete form walls, the maximum bearing wall height per story as permitted by Section 5611 tables plus a height of floor framing not to exceed 16 inches.

Individual walls or walls studs shall be permitted to exceed these limits as permitted by Chapter 56 provisions, provided story heights are not exceeded. An engineered design, *provided by a Massachusetts-registered professional engineer or architect* shall be provided for the wall or wall framing members when they exceed the limits of Chapter 56. Where the story height limits are exceeded, an engineered design shall be provided *addressing* the overall wind force resisting systems *and utilizing the wind loads of this code*.

**5301.4 Dead load.** The actual weights of materials and construction shall be used for determining dead load with consideration for the dead load of fixed service equipment.

**5301.5 Live load.** The minimum uniformly distributed live load shall be as provided in Table 5301.5.

**5301.6 Roof load.** Roof shall be designed for the live load indicated in Table 5301.6 or the snow load *based on the Massa-*

*chusetts Ground Snow Load Table 5301.2(5)*, whichever is greater.

**5301.7 Deflection.** The allowable deflection of any structural member under the live load listed in Sections 5301.5 and 5301.6 shall not exceed the values in Table 5301.7.

**TABLE 5301.5  
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS  
(in pounds per square foot)**

USE	LIVE LOAD
Attics with storage <sup>b</sup>	20
Attics without storage <sup>b</sup>	10
Decks <sup>c</sup>	40
Exterior balconies	60
Fire escapes	40
Guardrails and handrails <sup>d</sup>	200
Guardrails in-fill components <sup>f</sup>	50
Passenger vehicle garages <sup>a</sup>	50 <sup>a</sup>
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40 <sup>c</sup>

For SI: 1 pound per square foot = 0.0479 kN/m<sup>2</sup>, 1 square inch = 645 mm<sup>2</sup>, 1 pound = 4.45 N.

- a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.
- b. No storage with roof slope not over 3 units in 12 units.
- c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.
- d. A single concentrated load applied in any direction at any point along the top.
- e. See Section 5502.2.1 for decks attached to exterior walls.
- f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.

**TABLE 5301.6  
MINIMUM ROOF LIVE LOADS IN POUNDS-FORCE  
PER SQUARE FOOT OF HORIZONTAL PROJECTION**

ROOF SLOPE	TRIBUTARY LOADED AREA IN SQUARE FEET FOR ANY STRUCTURAL MEMBER		
	0 to 200	201 to 600	Over 600
Flat or rise less than 4 inches per foot (1:3)	20	16	12
Rise 4 inches per foot (1:3) to less than 12 inches per foot (1:1)	16	14	12
Rise 12 inches per foot (1:1) and greater	12	12	12

For SI: 1 square foot = 0.0929 m<sup>2</sup>, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>, 1 inch per foot = 0.0833 mm/m.

**TABLE 5301.7**  
**ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS<sup>a,b,c</sup>**

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3/12 with no finished ceiling attached to rafters	L/180
Interior walls and partitions	H/180
Floors and plastered ceilings	L/360
All other structural members	L/240
Exterior walls with plaster or stucco finish	H/360
Exterior walls—wind loads <sup>a</sup> with brittle finishes	L/240
Exterior walls—wind loads <sup>a</sup> with flexible finishes	L/120

**Note:** L = span length, H = span height.

- a. The wind load shall be permitted to be taken as 0.7 times the Component and Cladding loads for the purpose of the determining deflection limits herein.
- b. For cantilever members, L shall be taken as twice the length of the cantilever.
- c. For aluminum structural members or panels used in roofs or walls of sunroom additions or patio covers, not supporting edge of glass or sandwich panels, the total load deflection shall not exceed L/60. For sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed L/120.

**5301.8 Nominal sizes.** For the purposes of this code, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions.

## SECTION 5302 LOCATION ON LOT

**5302.1 Exterior walls.** Exterior walls with a fire separation distance less than 3 feet (914 mm) shall have not less than a one-hour fire-resistive rating with exposure from both sides. Projections shall not extend to a point closer than 2 feet (610 mm) from the line used to determine the fire separation distance.

**Exception:** Detached garages accessory to a dwelling located within 2 feet of a lot line may have roof eave projections not exceeding 4 inches *unless precluded by zoning bylaws*.

Projections extending into the fire separation distance shall have not less than one-hour fire-resistive construction on the underside. The above provisions shall not apply to walls which are perpendicular to the line used to determine the fire separation distance.

**Exception:** Tool and storage sheds, playhouses and similar structures exempted from permits by 5105.2 are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line *or otherwise conflict with zoning bylaw requirements*.

**5302.2 Openings.** Openings shall not be permitted in the exterior wall of a dwelling or accessory building with a fire separation distance less than 3 feet (914 mm). This distance shall be measured perpendicular to the line used to determine the fire separation distance.

### Exceptions:

1. Openings shall be permitted in walls that are perpendicular to the line used to determine the fire separation distance.
2. Foundation vents installed in compliance with this code are permitted.

**5302.3 Penetrations.** Penetrations located in the exterior wall of a dwelling with a fire separation distance less than 3 feet (914 mm) shall be protected in accordance with Section 5317.3.

**Exception:** Penetrations shall be permitted in walls that are perpendicular to the line used to determine the fire separation distance.

## SECTION 5303 LIGHT, VENTILATION AND HEATING

**5303.1 Habitable rooms.** All habitable rooms shall be provided with aggregate glazing area of not less than 8 percent of the floor area of such rooms. Natural ventilation shall be through windows, doors, louvers or other approved openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

### Exceptions:

1. The glazed areas need not be openable where the opening is not required by Section 5310 and an approved mechanical ventilation system is provided capable of producing 0.35 air change per hour in the room or a whole-house mechanical ventilation system is installed capable of supplying outdoor ventilation air of 15 cubic feet per minute (cfm) (7.08 L/s) per occupant computed on the basis of two occupants for the first bedroom and one occupant for each additional bedroom.
2. The glazed areas need not be provided in rooms where Exception 1 above is satisfied and artificial light is provided capable of producing an average illumination of 6 footcandles (6.46 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

**5303.2 Adjoining rooms.** For the purpose of determining light and ventilation requirements, any room shall be considered as a portion of an adjoining room when at least one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room but not less than 25 square feet (2.32 m<sup>2</sup>).

**Exception:** Openings required for light and/or ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover, provided that there is an openable area between the adjoining room and the sunroom addition or patio cover of not less than one-tenth of the floor area of the interior room but not less than 20 square feet (1.86 m<sup>2</sup>). The minimum openable area to the outdoors shall be based upon the total floor area being ventilated.

**5303.3 Bathrooms.** Bathrooms, water closet compartments and other similar rooms shall be provided with aggregate glazing area in windows of not less than 3 square feet (0.279 m<sup>2</sup>), one-half of which must be openable.

**Exception:** The glazed areas shall not be required where artificial light and a mechanical ventilation system are provided. The minimum ventilation rates shall be 50 cfm (23.6 L/s) for intermittent ventilation or 20 cfm (9.4 L/s) for continuous ventilation. Ventilation air from the space shall be exhausted directly to the outside.

*Notes: Mechanical ventilation of bathrooms containing a shower or bathtub is required at the ventilation rates noted in 5303.3 Exception.*

*Exhaust fans are not required by this code in half-bathrooms. (For the purposes of this section, half-bathrooms are defined as those bathrooms that contain only a toilet and sink.)*

*Massachusetts State Sanitary Code 105 CMR and/or Massachusetts Fuel Gas and Plumbing Code 248 CMR may require exhaust fans.*

**5303.4 Opening location.** Outdoor intake and exhaust openings shall be located in accordance with Sections 5303.4.1 and 5303.4.2.

**5303.4.1 Intake openings.** Mechanical and gravity outdoor air intake openings shall be located a minimum of 10 feet (3048 mm) from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks, except as otherwise specified in this code. Where a source of contaminant is located within 10 feet (3048 mm) of an intake opening, such opening shall be located a minimum of 2 feet (610 mm) below the contaminant source.

For the purpose of this section, the exhaust from dwelling unit toilet rooms, bathrooms and kitchens shall not be considered as hazardous or noxious.

**5303.4.2 Exhaust openings.** Outside exhaust openings shall be located so as not to create a nuisance. Exhaust air shall not be directed onto walkways.

**5303.5 Outside opening protection.** Air exhaust and intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles having a minimum opening size of 1/4 inch (6.4 mm) and a maximum opening size of 1/2 inch (12.7 mm), in any dimension. Openings shall be protected against local weather conditions. Outdoor air exhaust and intake openings shall meet the provisions for exterior wall opening protectives in accordance with this code.

**5303.6 Stairway illumination.** All interior and exterior stairways shall be provided with *an artificial light source* to illuminate the stairs, including the landings and treads.

*Such artificial light source shall comply with all applicable requirements of 527 CMR 12.*

**5303.6.1 Light activation.** The control for activation of the required interior stairway lighting *shall conform to the requirements of 527 CMR 12.*

**5303.7 Required glazed openings.** Required glazed openings shall open directly onto a street or public alley, or a yard or court located on the same lot as the building.

**5303.7.1 Roofed porches.** Required glazed openings may face into a roofed porch where the porch abuts a street, yard or court and the longer side of the porch is at least 65 percent open and unobstructed and the ceiling height is not less than 7 feet (2134 mm).

**5303.8 Required heating.** *Refer to 105 CMR when applicable to rental property.*

## SECTION 5304 MINIMUM ROOM AREAS

**5304.1 Minimum area.** Every dwelling unit shall have at least one habitable room that shall have not less than **150 square** feet of gross floor area.

**5304.2 Other rooms.** Other habitable rooms shall have a floor area of not less than 70 square feet (6.5 m<sup>2</sup>).

**Exception:** Kitchens.

**5304.3 Minimum dimensions.** Habitable rooms shall not be less than 7 feet (2134 mm) in any horizontal dimension.

**Exception:** Kitchens.

**5304.4 Height effect on room area.** Portions of a room with a sloping ceiling measuring less than 5 feet (1524 mm) or a furred ceiling measuring less than 7 feet (2134 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.

## SECTION 5305 CEILING HEIGHT

**5305.1 Minimum height.** Habitable rooms, hallways, corridors, bathrooms, toilet rooms, laundry rooms and basements shall have a ceiling height of not less than 7 feet (2134 mm). The required height shall be measured from the finish floor to the lowest projection from the ceiling.

**Exceptions:**

1. Beams and girders spaced not less than 4 feet (1219 mm) on center may project not more than 6 inches (152 mm) below the required ceiling height.
2. Ceilings in basements without habitable spaces may project to within 6 feet, 8 inches (2032 mm) of the finished floor; and beams, girders, ducts or other obstructions may project to within 6 feet, 4 inches (1931 mm) of the finished floor.
3. Not more than 50 percent of the required floor area of a room or space is permitted to have a sloped ceiling less than 7 feet (2134 mm) in height with no portion of the required floor area less than 5 feet (1524 mm) in height.
4. Bathrooms shall have a minimum ceiling height of 6 feet 8 inches (2036 mm) over the fixture and at the front clearance area for fixtures as shown in Figure 5307.2. A shower or tub equipped with a showerhead

shall have a minimum ceiling height of 6 feet 8 inches (2036 mm) above a minimum area 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.

### SECTION 5306

#### SANITATION AND ELECTRICAL REQUIREMENTS (where applicable, refer to 248 CMR and/or Title 5 via 310 CMR 15 and/or 105 CMR and/or 527 CMR 12)

**5306.1 Toilet facilities.** Every dwelling unit shall be provided with a water closet, lavatory, and a bathtub or shower *conforming to the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code).*

**5306.2 Kitchen.** Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink *conforming to the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code).*

**5306.3 Sewage disposal.** All plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system.

**5306.4 Water supply to fixtures.** All plumbing fixtures shall be connected to an approved water supply. Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water; *all such requirements conforming to the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code).*

**5306.5 Electrical Code.** See 527 CMR 12.

### SECTION 5307

#### TOILET, BATH AND SHOWER SPACES

**5307.1 Space required.** Fixtures shall be spaced as *required by the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code).*

**5307.2 Bathtub and shower spaces.** Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than 6 feet (1829 mm) above the floor (*also see 248 CMR*).

### SECTION 5308 GLAZING

**5308.1 Identification.** Except as indicated in Section 5308.1.1, *and as required by CPSC 16 CFR (Code of Federal Regulations); 1201 and Massachusetts General Law MGL Chapter 143 §§ 3t, 3U and 3T*, each pane of glazing installed in hazardous locations as defined in Section 5308.4 shall be provided with a manufacturer's, *fabricator's* or installer's label, designating the type and thickness of glass and the safety glazing standard with which it complies, which is visible in the final installation. The label shall be acid etched, sandblasted, ceramic-fired, embossed mark, or shall be of a type which once applied cannot be removed without being destroyed.

*Note: also refer to Chapter 61 of of this code relative to the National Fenestration Rating Council (NFRC) listing.*

#### Exceptions:

1. For other than tempered glass, labels may be omitted provided the building official approves the use of a certificate, affidavit or other evidence confirming compliance with this code.
2. Tempered spandrel glass may be identified by the manufacturer with a removable paper label.

**5308.1.1 Identification of multipane assemblies.** Multi-pane assemblies having individual panes not exceeding 1 square foot (0.09 m<sup>2</sup>) in exposed area shall have at least one pane in the assembly identified in accordance with Section 5308.1. All other panes in the assembly shall be labeled "16 CFR 1201."

**5308.2 Louvered windows or жалюзи.** Regular, float, wired or patterned glass in жалюзи and louvered windows shall be no thinner than nominal  $\frac{3}{16}$  inch (4.76 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

**5308.2.1 Wired glass prohibited.** Wired glass with wire exposed on longitudinal edges shall not be used in жалюзи or louvered windows.

**5308.3 Human impact loads.** Individual glazed areas including glass mirrors in hazardous locations such as those indicated as defined in Section 5308.4 shall pass the test requirements of CPSC 16 CFR, Part 1201. Glazing shall comply with the CPSC

TABLE 5308.3  
MINIMUM CATEGORY CLASSIFICATION OF GLAZING

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category Class)	GLAZING IN DOORS (Category Class)	GLAZED PANELS REGULATED BY ITEM 7 OF SECTION 5308.4 (Category Class)	GLAZED PANELS REGULATED BY ITEM 6 OF SECTION 5308.4 (Category Class)	GLAZING IN DOORS AND ENCLOSURES REGULATED BY ITEM 5 OF SECTION 5308.4 (Category Class)	SLIDING GLASS DOORS PATIO TYPE (Category Class)
9 sq. ft. or less	I	I	NR <sup>a</sup>	I	II	II
More than 9 sq. ft	II	II	II	II	II	II

For SI: 1 square foot = 0.0929 m<sup>2</sup>.

<sup>a</sup>NR means "No Requirement."

16 CFR, Part 1201 criteria for Category I or Category II as indicated in Table 5308.3.

**Exceptions:**

1. Polished wired glass for use in fire doors and other fire resistant locations shall comply with ANSI Z97.1.
2. Louvered windows and jalousies shall comply with Section 5308.2.

**5308.4 Hazardous locations.** *The following locations, as established by Massachusetts General Law MGL Chapter 143 § 3T and as herein specified, shall be considered specific hazardous locations for the purposes of glazing:*

1. Glazing in swinging doors except jalousies.
2. Glazing in fixed and sliding panels of sliding door assemblies and panels in sliding and bifold closet door assemblies.
3. Glazing in storm doors.
4. Glazing in all unframed swinging doors.
5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing in any part of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface.
6. Glazing, in an individual fixed or operable panel adjacent to a door where the nearest vertical edge is within a 24-inch (610 mm) arc of the door in a closed position and whose bottom edge is less than 60 inches (1524 mm) above the floor or walking surface.
7. Glazing in an individual fixed or operable panel, other than those locations described in Items 5 and 6 above, that meets all of the following conditions:
  - 7.1. Exposed area of an individual pane greater than 9 square feet (0.836 m<sup>2</sup>).
  - 7.2. Bottom edge less than 18 inches (457 mm) above the floor.
  - 7.3. Top edge greater than 36 inches (914 mm) above the floor.
  - 7.4. One or more walking surfaces within 36 inches (914 mm) horizontally of the glazing.
8. All glazing in railings regardless of an area or height above a walking surface. Included are structural baluster panels and nonstructural in-fill panels.
9. Glazing in walls and fences enclosing indoor and outdoor swimming pools, hot tubs and spas where the bottom edge of the glazing is less than 60 inches (1524 mm) above a walking surface and within 60 inches (1524 mm) horizontally of the water's edge. This shall apply to single glazing and all panes in multiple glazing.
10. Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface when the exposed surface of the glass is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.

11. Glazing adjacent to stairways within 60 inches (1524 mm) horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60 inches (1524 mm) above the nose of the tread.

**12. Fixed glazed panels adjacent to entrance and exit doors which, because of their location, present a barrier in the normal path traveled by persons going into or out of these buildings, and because of their size and design may be mistaken as means of egress.**

**Exception:** The following products, materials and uses are exempt from the above hazardous locations:

1. Openings in doors through which a 3-inch (76 mm) sphere is unable to pass.
2. Decorative glass in Items 1, 6 or 7.
3. Glazing in Section 5308.4, Item 6, when there is an intervening wall or other permanent barrier between the door and the glazing.
4. Glazing in Section 5308.4, Item 6, in walls perpendicular to the plane of the door in a closed position or where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. Glazing in these applications shall comply with Section 5308.4, Item 7.
5. Glazing in Section 5308.4, Items 7 and 10, when a protective bar is installed on the accessible side(s) of the glazing 36 inches × 2 inches (914 mm × 51 mm) above the floor. The bar shall be capable of withstanding a horizontal load of 50 pounds per linear foot (74.5 kg/m) without contacting the glass and be a minimum of 1½ inches (38 mm) in height.
6. Outboard panes in insulating glass units and other multiple glazed panels in Section 5308.4, Item 7, when the bottom edge of the glass is 25 feet (7620 mm) or more above grade, a roof, walking surface, or other horizontal [within 45 degrees (0.79 rad) of horizontal] surface adjacent to the glass exterior.
7. Louvered windows and jalousies complying with the requirements of Section 5308.2.
8. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.
9. Safety glazing in Section 5308.4, Items 10 and 11 is not required where:
  - 9.1. The side of a stairway, landing or ramp has a guardrail or handrail, including balusters or in-fill panels, complying with the provisions of Sections 1003.3.12 and 1607.7 *Sixth Edition, Massachusetts Building Code*; and
  - 9.2. The plane of the glass is greater than 18 inches (457 mm) from the railing.

**5308.5 Site built windows.** Site built windows shall comply with Section 2404 of the *Sixth Edition, Massachusetts State Building Code but utilizing the wind loads of this code; note that seismic design is not required.*

**5308.6 Skylights and sloped glazing.** Skylights and sloped glazing shall comply with the following sections.

#### 5308.6.1 Definitions.

**SKYLIGHTS AND SLOPED GLAZING.** Glass or other transparent or translucent glazing material installed at a slope of more than 15 degrees (0.26 rad) from vertical. Glazing materials in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls are included in this definition.

**UNIT SKYLIGHT.** A factory assembled, glazed fenestration unit, containing one panel of glazing material, that allows for natural daylighting through an opening in the roof assembly while preserving the weather resistant barrier of the roof.

**5308.6.2 Permitted materials.** The following types of glazing may be used:

1. Laminated glass with a minimum 0.015-inch (0.38 mm) polyvinyl butyral interlayer for glass panes 16 square feet (1.5 m<sup>2</sup>) or less in area located such that the highest point of the glass is not more than 12 feet (3658 mm) above a walking surface or other accessible area; for higher or larger sizes, the minimum interlayer thickness shall be 0.030 inch (0.76 mm).
2. Fully tempered glass.
3. Heat-strengthened glass.
4. Wired glass.
5. Approved rigid plastics.

**5308.6.3 Screens, general.** For fully tempered or heat-strengthened glass, a retaining screen meeting the requirements of Section 5308.6.7 shall be installed below the glass, except for fully tempered glass that meets either condition listed in Section 5308.6.5.

**5308.6.4 Screens with multiple glazing.** When the inboard pane is fully tempered, heat-strengthened, or wired glass, a retaining screen meeting the requirements of Section 5308.6.7 shall be installed below the glass, except for either condition listed in Section 5308.6.5. All other panes in the multiple glazing may be of any type listed in Section 5308.6.2.

**5308.6.5 Screens not required.** Screens shall not be required when fully tempered glass is used as single glazing or the inboard pane in multiple glazing and either of the following conditions are met:

1. Glass area 16 square feet (1.49 m<sup>2</sup>) or less. Highest point of glass not more than 12 feet (3658 mm) above a walking surface or other accessible area, nominal glass thickness not more than  $\frac{3}{16}$  inch (4.76 mm), and (for multiple glazing only) the other pane or panes fully tempered, laminated or wired glass.

2. Glass area greater than 16 square feet (1.49 m<sup>2</sup>). Glass sloped 30 degrees (0.52 rad) or less from vertical, and highest point of glass not more than 10 feet (3048 mm) above a walking surface or other accessible area.

**5308.6.6 Glass in greenhouses.** Any glazing material is permitted to be installed without screening in the sloped areas of greenhouses, provided the greenhouse height at the ridge does not exceed 20 feet (6096 mm) above grade.

**5308.6.7 Screen characteristics.** The screen and its fastenings shall be capable of supporting twice the weight of the glazing, be firmly and substantially fastened to the framing members, and have a mesh opening of no more than 1 inch by 1 inch (25.4 mm by 25.4 mm).

**5308.6.8 Curbs for skylights.** All unit skylights installed in a roof with a pitch flatter than three units vertical in 12 units horizontal (25-percent slope) shall be mounted on a curb extending at least 4 inches (102 mm) above the plane of the roof unless otherwise specified in the manufacturer's installation instructions.

**5308.6.9 Testing and labeling.** Unit skylights shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance grade rating, and approved inspection agency to indicate compliance with the requirements of AAMA/WDMA 101/I.S.2/NAFS.

## SECTION 5309 GARAGES AND CARPORTS

**5309.1 Opening protection.** Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than  $1\frac{3}{8}$  inches (35 mm) in thickness, solid or honeycomb core steel doors not less than  $1\frac{3}{8}$  inches (35 mm) thick, or 20-minute fire-rated doors.

*All such panel doors shall be labeled with a minimum 20-minute fire-resistance rating. Self-closing devices and fire-resistive-rated door frames are not required. All door openings between the garage floor and the dwelling shall be provided with a raised sill with a minimum height of 4 inches (102 mm).*

**5309.1.1 Duct penetration.** Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage (0.48 mm) sheet steel or other approved material and shall have no openings into the garage.

**5309.2 Separation required.** The garage shall be separated from the residence and its attic area by not less than  $\frac{5}{8}$  inch **Type X gypsum board or equivalent (15.9 mm)** gypsum board applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than  $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum board or equivalent. Where the separation is a floor-ceiling assembly, the structure supporting the separation shall also be protected by not less than  $\frac{5}{8}$ -inch (15.9 mm) gypsum board or equivalent.

**5309.3 Floor surface.** Garage floor surfaces shall be of approved noncombustible material.



The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway. *Concrete floors shall be installed as required by Section 5506.*

**5309.4 Carports.** Carports shall be open on at least two sides. Carport floor surfaces shall be of approved noncombustible material. Carports not open on at least two sides shall be considered a garage and shall comply with the provisions of this section for garages.

**Exception:** Asphalt surfaces shall be permitted at ground level in carports.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

**5309.5 Flood hazard areas.** For buildings located in flood hazard areas as established by *the applicable FEMA Flood Insurance Rate Map(s)* garage floors shall be:

1. Elevated to or above the design flood elevation as determined in Section 5323; or
2. Located below the design flood elevation provided they are at or above grade on all sides, are used solely for parking, building access, or storage, meet the requirements of Section 5323, and are otherwise constructed in accordance with this code.

**5309.6 Automatic garage door openers.** Automatic garage door openers, if provided, shall be listed in accordance with UL 325.

## SECTION 5310 EMERGENCY ESCAPE AND RESCUE OPENINGS

**5310.1 Emergency escape and rescue required.** Basements with habitable space and every sleeping room shall have at least one openable emergency escape and rescue opening. Where basements contain one or more sleeping rooms, emergency egress and rescue openings shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Where emergency escape and rescue openings are provided they shall have a sill height of not more than 44 inches (1118 mm) above the floor. Where a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with Section 5310.3. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. Emergency escape and rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with Section 5310.2.

**5310.1.1 Minimum opening area.** All emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.530 m<sup>2</sup>).

### *Exceptions:*

1. *Grade floor openings shall have a minimum net clear opening of 5 square feet (0.465 m<sup>2</sup>).*

2. *Double hung windows used for emergency escape shall be permitted to have a net clear opening of 3.3 square feet (0.31 m<sup>2</sup>) provided that at least one operable sash meets the minimum height and width required by Sections 5310.1.2 and 5310.1.3 and operational constraints defined by Section 5310.1.4.*

**5310.1.2 Minimum opening height.** The minimum net clear opening height shall be 20 inches (508 mm).

**5310.1.3 Minimum opening width.** The minimum net clear opening width shall be 24 inches (610 mm).

**5310.1.4 Operational constraints.** Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools.

**5310.2 Window wells.** The minimum horizontal area of the window well shall be 9 square feet (0.84 m<sup>2</sup>), with a minimum horizontal projection and width of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

**Exception:** The ladder or steps required by Section 5310.2.1 shall be permitted to encroach a maximum of 6 inches (152 mm) into the required dimensions of the window well.

**5310.2.1 Ladder and steps.** Window wells with a vertical depth greater than 44 inches (1118 mm) shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by this section shall not be required to comply with Sections 5311.5 and 5311.6. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center vertically for the full height of the window well.

**5310.3 Bulkhead enclosures.** Bulkhead enclosures shall provide direct access to the basement. The bulkhead enclosure with the door panels in the fully open position shall provide the minimum net clear opening required by Section 5310.1.1. Bulkhead enclosures shall also comply with Section 5311.5.8.2.

**5310.4 Bars, grills, covers and screens.** Bars, grills, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided the minimum net clear opening size complies with Sections 5310.1.1 to 5310.1.3, and such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening. *Also see 527 CMR as referenced in Appendix A.*

## SECTION 5311 MEANS OF EGRESS

**5311.1 General.** Stairways, ramps, exterior exit balconies, hallways and doors shall comply with this section.

**5311.2 Construction.**

**5311.2.1 Attachment.** Required exterior exit balconies, stairs and similar exit facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

**5311.2.2 Under stair protection.** Enclosed accessible space under stairs shall have walls, under stair surface and any soffits protected on the enclosed side with  $\frac{1}{2}$ -inch (12.7 mm) gypsum board.

**5311.3 Hallways.** The minimum width of a hallway shall be not less than 3 feet (914 mm).

#### 5311.4 Doors.

**5311.4.1 Exit doors required.** Egress from all dwelling units shall be by means of two exit doors, remote as possible from each other and leading directly to grade. Such doors shall be provided at the normal level of entry/exit. In addition, all other floors within a dwelling unit shall have at least one means by which a continuous and unobstructed path leads to the exit doors. Such continuous and unobstructed paths shall be by means of stairways, corridors, hallways or combinations thereof.

*Exception: In split-level and raised ranch style layouts, the two separate exit doors required by this section are permitted to be located on different levels.*

**5311.4.2 Exit door types and sizes.** The minimum nominal width of at least one of the exit doors required by Section 5311.4 shall not be less than 36 inches (914 mm) in width and the minimum nominal height shall be 6 feet, 8 inches (2032 mm). The 36-inch (914 mm) exit door shall be side-hinged. All other required exit doors and doors leading to or from enclosed stairways, or to interior vestibules shall not be less than 32 inches (813 mm) in nominal width or less than 6 feet, 8 inches (2032 mm) in nominal height and maybe of the sliding or side-hinged type. The 36-inch (914 mm) required exit door shall provide for direct access from the habitable portions of the dwelling to the exterior without requiring travel through a garage. The 32-inch (813 mm) secondary exit door may provide egress through an attached garage, provided that the attached garage is also provided with a 32-inch (813 mm) exit door meeting the requirements of this section. Side-hinged swinging doors provided to meet these requirements are permitted to swing inward.

*Other exterior doors, in excess of the two required exit doors, whether side-hinged or sliding-type doors, shall not be required to comply with these minimum dimensions.*

**5311.4.2.1 Interior doors.** All doors providing access to habitable rooms shall have a minimum nominal width of 30 inches (762 mm) and a minimum nominal height of 6 feet, 6 inches (1981 mm).

##### Exceptions:

1. Doors providing access to bathrooms are permitted to be 28 inches (711 mm) in nominal width.

#### 2. Doors providing access to bathrooms in existing buildings are permitted to be 24 inches (610 mm) in nominal width.

**5311.4.3 Landings at doors.** There shall be a floor or landing on each side of each exterior door.

##### Exceptions:

1. Where a stairway of two or fewer risers is located on the exterior side of a door, other than the required exit door, a landing is not required for the exterior side of the door.

The floor or landing at the exit door required by Section 5311.4.1 shall not be more than 1.5 inches (38 mm) lower than the top of the threshold. The floor or landing at exterior doors other than the exit door required by Section 5311.4.1 shall not be required to comply with this requirement but shall have a rise no greater than that permitted in Section 5311.5.3.

2. The landing at an exterior doorway shall not be more than  $7\frac{3}{4}$  inches (196 mm) below the top of the threshold, provided the door, other than an exterior storm or screen door does not swing over the landing.

The width of each landing shall not be less than the door served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

**5311.4.4 Type of lock or latch.** All egress doors shall be readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort.

#### 5311.5 Stairways.

**5311.5.1 Width.** Stairways shall not be less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4.5 inches (114 mm) on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31.5 inches (787 mm) where a handrail is installed on one side and 27 (698 mm) where handrails are provided on both sides.

**Exception:** The width of spiral stairways shall be in accordance with Section 5311.5.8.

**5311.5.2 Headroom.** The minimum headroom in all parts of the stairway shall not be less than 6 feet 6 inches (1981 mm) measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of the landing or platform.

*Exception: Minimum headroom under a sloped ceiling in an existing building shall be maintained for a minimum width of 36 inches (914 mm) as measured from the side of the stair with the continuous handrail*

#### 5311.5.3 Stair treads and risers.

**5311.5.3.1 Riser height.** The maximum riser height shall be  $8\frac{1}{4}$  inches (210 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than  $\frac{3}{8}$  inch (9.5 mm).

**5311.5.3.2 Tread depth.** The minimum tread depth shall be 9 inches (229 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than  $\frac{3}{8}$  inch (9.5 mm). Winder treads shall have a minimum tread depth *equal to the tread depth of the straight run portion of the stairs* measured as above at a point 12 inches (305 mm) from the side where the treads are narrower. Winder treads shall have a minimum tread depth of 3 inches (76 mm) at any point. Within any flight of stairs, the greatest winder tread depth at the 12 inch (305 mm) walk line shall not exceed the smallest by more than  $\frac{3}{8}$  inch (9.5 mm).

*Exception: Forty-five degree winders are allowed to go to a minimum of 2 inches (51 mm) at any point.*

**5311.5.3.3 Profile.** *Nosings shall not project more than  $1\frac{1}{2}$  inches (38 mm) beyond the face of the riser below. Open risers are permitted, provided that the opening between treads does not permit the passage of a 5-inch-diameter (127 mm) sphere.*

*Exceptions:*

1. *A nosing is not required where the tread depth is a minimum of 11 inches (279 mm).*
2. *The opening between adjacent treads is not limited on and the minimum width of any tread is not less than 6 inches (152 mm). The continuous handrail required by Section 5315.1 shall be located on the side where the tread is narrower.*

**5311.5.4 Landings for stairways.** There shall be a floor or landing at the top and bottom of each stairway.

**Exception:** A floor or landing is not required at the top of an interior flight of stairs, provided a door does not swing over the stairs.

A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

The width of each landing shall not be less than the stairway served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

**5311.5.5 Stairway walking surface.** The walking surface of treads and landings of stairways shall be sloped no steeper than one unit vertical in 48 inches horizontal (2-percent slope).

**5311.5.6 Handrails.** Handrails shall be provided on at least one side of each continuous run of treads or flight with *three* or more risers.

**5311.5.6.1 Height.** Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

**5311.5.6.2 Continuity.** Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than  $1\frac{1}{2}$  inch (38 mm) between the wall and the handrails.

**Exceptions:**

1. Handrails shall be permitted to be interrupted by a newel post at the turn.
2. The use of a volute, turnout, starting easing or starting newel shall be allowed over the lowest tread.

**5311.5.6.3 Handrail grip size.** All required handrails shall be of one of the following types or provide equivalent graspability.

1. **Type I.** Handrails with a circular cross section shall have an outside diameter of at least  $1\frac{1}{4}$  inches (32 mm) and not greater than  $2\frac{3}{4}$  inches (70 mm). If the handrail is not circular it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than  $6\frac{1}{4}$  inches (160 mm) with a maximum cross section of dimension of  $2\frac{1}{4}$  inches (57 mm).
2. **Type II.** Handrails with a perimeter greater than  $6\frac{1}{4}$  inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of  $\frac{3}{4}$  inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least  $\frac{5}{16}$  inch (8 mm) within  $\frac{7}{8}$  inch (22 mm) below the widest portion of the profile. This required depth shall continue for at least  $\frac{3}{8}$  inch (10 mm) to a level that is not less than  $1\frac{3}{4}$  inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be  $1\frac{1}{4}$  inches (32 mm) to a maximum of  $2\frac{3}{4}$  inches (70 mm). Edges shall have a minimum radius of 0.01 inches (0.25 mm).

**5311.5.7 Illumination.** All stairs shall be provided with illumination in accordance with Section 5303.6.

**5311.5.8 Special stairways.** Circular stairways, spiral stairways, winders and bulkhead enclosure stairways shall comply with all requirements of Section 5311.5 except as specified below.

**5311.5.8.1 Spiral stairways.** Spiral stairways are permitted, provided the minimum width shall be 26 inches (660 mm) with each tread having a  $7\frac{1}{2}$ -inches (190 mm) minimum tread depth at 12 inches from the narrower edge. All treads shall be identical, and the rise shall be no

more than 9½ inches (241 mm). A minimum headroom of 6 feet 6 inches (1982 mm) shall be provided.

**5311.5.8.2 Bulkhead enclosure stairways.** Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside grade level to the basement shall be exempt from the requirements of Sections 5311.4.3 and 5311.5 where the maximum height from the basement finished floor level to grade adjacent to the stairway does not exceed 8 feet (2438 mm), and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

### 5311.6 Ramps.

**5311.6.1 Maximum slope.** Ramps *that are part of a means of egress and are attached to a dwelling unit* shall have a maximum slope of one unit vertical in eight units horizontal (12.5-percent slope).

**5311.6.2 Landings required.** A minimum 3-foot-by-3-foot (914 mm by 914 mm) landing shall be provided:

1. At the top and bottom of ramps,
2. Where doors open onto ramps,
3. Where ramps change direction.

**5311.6.3 Handrails required.** Handrails shall be provided on at least one side of all ramps *that are part of a means of egress and are attached to a dwelling unit(s) where the ramp* exceeds a slope of one unit vertical in 12 units horizontal (8.33-percent slope).

**Exception:** *For persons with disabilities, handrails shall be provided on both sides of the ramp when the vertical rise between landings exceeds 6 inches (152 mm).*

**5311.6.3.1 Height.** Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

**5311.6.3.2 Handrail grip size.** Handrails on ramps shall comply with Section 5311.5.6.3.

**5311.6.3.3 Continuity.** Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1.5 inches (38 mm) between the wall and the handrails.

## SECTION 5312 GUARDS

**5312.1 Guards required.** Porches, balconies or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914 mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 34 inches (864 mm) in height measured vertically from the nosing of the treads.

Porches and decks which are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

**5312.2 Guard opening limitations.** Required guards on open sides of stairways, raised floor areas, balconies and porches shall have intermediate rails or ornamental closures which do not allow passage of a sphere **5 inches (127 mm)** or more in diameter.

### Exceptions:

1. The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of a stairway are permitted to be of such a size that a sphere 6 inches (152 mm) cannot pass through.
2. Openings for required guards on the sides of stair treads shall not allow a sphere 4¾ inches (107 mm) to pass through.

## SECTION 5313 LIFE SAFETY SYSTEMS

### 5313.1 Definitions.

**MULTIPLE-STATION ALARM DEVICE.** *Two or more single-station devices (smoke or heat detector or carbon monoxide detector) that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate.*

**SINGLE-STATION ALARM DEVICE.** *An assembly incorporating the detector (smoke or heat detector or carbon monoxide detector), control equipment and alarm sounding device in one unit that is operated from a power supply either in the unit or obtained at the point of installation.*

**SYSTEM-TYPE DEVICE.** *A device designed to be connected to a fire alarm control unit (panel). Low-power radio transmitting (wireless) systems are included as part of this definition.*

### 5313.2 Household fire-warning systems.

**5313.2.1 General.** *The household fire-warning system shall be single or multiple station or of the system type and shall consist of smoke detectors and heat detectors as required herein.*

*Where more than 12 smoke alarms (detectors) are installed, system-type devices must be utilized.*

**5313.2.2 Listing and installation requirements.** *All fire detection, notification and protection equipment and devices shall be listed and installed in accordance with the provisions of Section 5313.2, the manufacturer's instructions, the listing criteria, 527 CMR 12.00 and NFPA 72, as applicable.*

**5313.2.3 Interconnection within a dwelling unit.** *When more than one code-required detector must be installed, the code-required detectors shall be compatible and interconnected in such a manner that the actuation of one detector will activate all of the audible alarms.*

**5313.2.4 Audible alarm intensity.** All required alarm sounding appliances shall have a minimum rating of 85 dBA at 10 feet (3048 mm). Where audible appliances are installed to provide signals for sleeping areas, they shall have a sound level of at least 75 dBA measured at the pillow level in the sleeping area.

**5313.2.5 Power source.** All power sources and wiring must be permanent and in accordance with 527 CMR 12.00.

**5313.2.5.1 Primary electrical power for single-station and multiple-station devices.** Power for single- and multiple-station devices shall be supplied from a permanently wired connection directly to an AC primary source of power. All power for AC-powered devices shall be taken from either a dedicated locked branch circuit or a single branch circuit, which also provides other electrical service to a habitable space. The power source shall be on the supply side, ahead of any switches.

**5313.2.5.2 Primary electrical power for system-type household fire-warning systems.** System-type household fire-warning systems that include a listed control unit with automatic detectors and occupant notification appliances shall be powered from a permanently wired AC primary power source. Such AC primary power shall be supplied either from a dedicated locked branch circuit or the unswitched portion of a branch circuit also used for power and lighting of a habitable space, in accordance with the requirements of NFPA 72 and 527 CMR 12.00.

**Exception:** Wireless systems when installed in accordance with NFPA 72

**5313.2.5.3 Secondary electrical power.** In addition to required primary electrical power, all household fire-warning systems shall have secondary (standby) power supplied from monitored batteries in accordance with NFPA 72. For fire alarm control units (panels), the panel battery shall serve as the source of secondary electrical power. For wireless systems, the panel battery shall serve as the source of secondary electrical power.

**5313.2.6 Acceptance testing.** When the installation of the household fire-warning system is complete, it shall be subject to a 100-percent acceptance test in accordance with Section 5313 and NFPA 72.

**5313.2.7 Maintenance.** It shall be the responsibility of the owner, as defined in Chapter 2, to properly maintain the household fire-warning system in accordance with manufacturer's recommendations and NFPA 72.

**5313.2.8 Manufactured homes (housing).** The installation of household fire-warning systems for buildings designed and constructed as manufactured homes and/or housing as defined by 24 CFR, Part 5208.2, shall be in accordance with approved methods for such homes and/or housing as defined 24 CFR and as such are not governed by this code.

**5313.2.9 Smoke detector required locations within the dwelling unit.** Smoke detectors shall be installed in the fol-

lowing locations (also refer to Board of Building Regulations and Standards Official Interpretation No. 49-98):

1. In each bedroom (sleeping room).
2. Outside each separate bedroom (sleeping room) in the immediate vicinity of the bedroom (sleeping room).
3. Near the base of all stairs where such stairs lead to another occupied floor.
4. On each additional story of the dwelling, including basements and cellars but not including crawl spaces and unoccupied attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke detector installed on the upper level shall suffice for the adjacent lower level, provided that the lower level is less than one full story below the upper level.
5. For each 1,200 square feet (111 m<sup>2</sup>) of area or part thereof.

**5313.2.10 Smoke detector required locations in common areas of two-family dwellings.** In addition to the requirements of Section 5313.1.9, Items 1-4, two-family dwellings that contain common areas such as basements, hallways and/or interior stairways that serve both dwelling units, but are not within the dwelling units, shall also be provided with smoke detectors and/or heat detectors, as required, in the following locations:

1. Smoke detectors—In all common basements.
2. Smoke detectors—In all common hallways.
3. Smoke detectors—In all common stairways on each level outside the dwelling unit doorways.
4. When common area smoke detectors are of the single/multiple-station type they shall be interconnected with listed compatible heat detectors containing a sounding device within each dwelling unit. Said heat detectors shall be on every level within each dwelling unit and shall meet the audibility requirement of Section 5313.2.4.
5. When common area smoke detectors are of the system type, there shall be at least one system-type alarm notification device that meets the requirements of Section 5313.2.4 on each level within each dwelling unit
6. Dwelling unit smoke detectors shall only sound within the dwelling unit.

**5313.2.11 Photo-electric smoke detectors.** Any smoke detector located within 20 feet (6096 mm) of a kitchen or a bathroom shall be a photo-electric-type smoke detector. Photo-electric-type smoke detectors shall be allowed to be located closer than 3 feet (914 mm) horizontally from a kitchen or a bathroom door when hallway or other room size restricts detector mounting options.

**Exception:** A bathroom not containing a tub, shower, jacuzzi or steam room.

**5313.2.12 Smoke detector placement.** Ionization and photo-electric smoke detectors shall be installed in accordance with the manufacturer's specific installation requirements. In the absence of manufacturer's recommendations, smoke detectors shall be mounted on the ceiling at least 4 inches (102 mm) from a wall or on a wall with the top of the alarm not less than 4 inches (102 mm) nor more than 12 inches (305 mm) below the ceiling.

*Exception: Smoke detector placement for solid joist or beam construction or for high, sloped, shed or peaked ceilings all shall be in accordance with manufacturer's recommendations and NFPA 72.*

**5313.2.13 Smoke detector requirements in existing dwellings.** See 780 CMR 93.

### **5313.3 Heat detectors.**

**5313.3.1 Required heat detectors.** A single heat detector listed for the ambient environment shall be installed in:

1. Any integral garage ("garage under") or attached garage to the main house (detached garages do not require a heat detector).
2. A new addition attached garage to an existing dwelling shall require a single heat detector installed in the garage in accordance with all applicable criteria of this (5313) section. If the existing house contains a fire detection system that is compatible with the garage heat detector, then said garage heat detector shall be interconnected to the existing dwelling fire detection system. Where the dwelling-proper existing fire detection system is not compatible with the garage heat detector, the garage heat detector shall be connected to a sounder (occupant notification appliance) or compatible heat detector containing a sounding device, located in the dwelling-proper and within 20 feet (6096 mm) of the nearest door to the garage from the dwelling-proper. The required garage heat detector is not required to incorporate audible alarm notification nor is any audible notification device required in the garage.

**5313.3.2 Heat detector placement.** For flat-finished ceilings, the single heat detector shall be placed on or near the center of the garage ceiling; for sloped ceilings having a rise to run of greater than 1 foot in 8 feet (305 mm in 2438 mm), the single heat detector shall be placed in the approximate center of the vaulted ceiling but no closer than 4 inches (102 mm) to any wall.

**5313.3.3 Heat detector interconnection.** The required single heat detector shall be listed for and required to be interconnected to all smoke detectors of the required household fire alarm system, such that the activation of the heat detector will activate all of the audible alarms of the required household fire alarm system throughout the building. The required heat detector is not required to incorporate audible alarm notification nor is any audible notification device required in the garage.

### **5313.4 Carbon monoxide detectors.**

**5313.4.1 General.** Carbon monoxide detectors shall either be listed 120V devices and secondary power shall not be required or shall be part of a listed low-voltage combination system as defined in NFPA 72.

**5313.4.2 Carbon monoxide detector listing and installation requirements.** All carbon monoxide detectors shall be UL 2034 listed and installed in accordance with the provisions of this code, the manufacturer's instructions, the listing criteria, 527 CMR 12.00 and NFPA 720. Required carbon monoxide detectors are not required to be interconnected to the required household fire alarm system but, where interconnection is desired, such carbon monoxide detectors shall be compatible with all interconnected fire detection devices and fire alarms shall have precedence over carbon monoxide alarms.

**5313.4.3 Carbon monoxide detector required locations.** One carbon monoxide detector shall be installed on each story of a dwelling unit, including basements and cellars (but not including crawl spaces and uninhabitable attics) in accordance with the manufacturer's instructions and the applicable requirements of NFPA 720.

*Also refer to 527 CMR 31 and 248 CMR as carbon monoxide detector required locations set forth in these regulations must also be met.*

**5313.4.4 Alarm intensity.** All alarm-sounding appliances shall have a minimum rating of 85 dBA at 10 feet (3048 mm).

**5313.4.5 Maintenance.** It shall be the responsibility of the owner to properly maintain the carbon monoxide detectors in accordance with the manufacturer's instructions and NFPA 720.

### **5313.5 Sprinklers.**

**5313.5.1 Dwellings requiring sprinklers.** Automatic sprinklers installed in accordance with NFPA 13D shall be installed in one- and two-family dwellings having an aggregate area greater than 14,400 square feet (1338 m<sup>2</sup>), including basements but not including garages and unfinished attics.

## **SECTION 5314 FOAM PLASTIC**

**5314.1 General.** The provisions of this section shall govern the requirements and uses of foam plastic insulation.

**5314.1.1 Surface burning characteristics.** Except where otherwise noted in Section 5314.2, all foam plastic or foam plastic cores in manufactured assemblies used in building construction shall have a flame-spread rating of not more than 75 and shall have a smoke-developed rating of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84.

**5314.1.2 Thermal barrier.** Foam plastic, except where otherwise noted, shall be separated from the interior of a building by minimum 1/2-inch (12.7 mm) gypsum board or an approved finish material equivalent to a thermal barrier to limit the average temperature rise of the unexposed surface

to no more than 250°F (121°C) after 15 minutes of fire exposure to the ASTM E 119 standard time temperature curve. The gypsum board shall be installed using a mechanical fastening system in accordance with Section 5702.3.5. Reliance on adhesives to ensure that the gypsum board will remain in place when exposed to fire shall be prohibited.

**5314.2 Specific requirements.** The following requirements shall apply to all uses of foam plastic unless specifically approved in accordance with Section 5314.3 or by other sections of the code.

**5314.2.1 Masonry or concrete construction.** Foam plastics may be used without the thermal barrier described in Section 5314.1 when the foam plastic is protected by a minimum 1-inch (25.4 mm) thickness of masonry or concrete.

**5314.2.2 Roofing.** Foam plastic may be used in a roof-covering assembly without the thermal barrier when the foam is separated from the interior of the building by wood structural panel sheathing in accordance with Section 5803, not less than  $1\frac{5}{32}$  inch (11.9 mm) in thickness bonded with exterior glue and identified as Exposure 1, with edge supported by blocking or tongue-and-groove joints. The smoke-developed rating shall not be limited.

**5314.2.3 Attics and crawlspaces.** Within attics and crawl-spaces where entry is made only for service of utilities, foam plastics shall be protected against ignition by  $1\frac{1}{2}$ -inch-thick (38 mm) mineral fiber insulation,  $\frac{1}{4}$ -inch-thick (6.4 mm) wood structural panels,  $\frac{3}{8}$ -inch (9.5 mm) particleboard,  $\frac{1}{4}$ -inch (6.4 mm) hardboard,  $\frac{3}{8}$ -inch (9.5 mm) gypsum board, or corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm).

**5314.2.4 Foam-filled doors.** Foam-filled doors are exempt from the requirements of Section 5314.1.

**5314.2.5 Siding backer board.** Foam plastic board of not more than  $\frac{1}{2}$ -inch (12.7 mm) thickness may be used as siding backer board when separated from interior spaces by not less than 2 inches (51 mm) of mineral fiber insulation or  $\frac{1}{2}$ -inch (12.7 mm) gypsum wallboard or installed over existing exterior wall finish in conjunction with re-siding, providing the plastic board does not have a potential heat of more than 2,000 Btu per square foot (22 720 kJ/m<sup>2</sup>) when tested in accordance with NFPA 259.

**5314.2.6 Interior trim.** Foam plastic trim defined as picture molds, chair rails, baseboards, handrails, ceiling beams, door trim and window trim may be installed, provided:

1. The minimum density is 20 pounds per cubic foot (3.14 kg/m<sup>3</sup>).
2. The maximum thickness of the trim is 0.5 inch (12.7 mm) and the maximum width is 4 inches (102 mm).
3. The trim constitutes no more than 10 percent of the area of any wall or ceiling.
4. The flame-spread rating does not exceed 75 when tested per ASTM E 84. The smoke-developed rating is not limited.

**5314.2.7 Sill plates and headers.** Foam plastic shall be permitted to be spray applied to a sill plate and header without thermal barrier subject to all of the following:

1. The maximum thickness of the foam plastic shall be  $\frac{3}{4}$  inches (82.6 mm).
2. The density of the foam plastic shall be in the range of 1.5 to 2.0 pcf (24 to 32 kg/m<sup>3</sup>).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke developed index of 450 or less when tested in accordance with ASTM E84.

**5314.3 Specific approval.** Plastic foam not meeting the requirements of Sections 5314.1 and 5314.2 may be specifically approved on the basis of one of the following approved tests: ASTM E 84, FM 4880, UL 1040, NFPA 286, ASTM E 152, or UL 1715, or fire tests related to actual end-use configurations. The specific approval may be based on the end use, quantity, location and similar considerations where such tests would not be applicable or practical.

**5314.4 Interior finish.** Foam plastics that are used as interior finish shall also meet the flame-spread requirements for interior finish.

**5314.5 Termite damage.** The use of foam plastics in areas of "very heavy" termite infestation probability shall be in accordance with Section 5320.4.

## SECTION 5315 FLAME SPREAD AND SMOKE DENSITY

**5315.1 Wall and ceiling.** Wall and ceiling finishes shall have a flame-spread classification of not greater than 200.

**Exception:** Flame-spread requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than  $\frac{1}{28}$  inch (0.907 mm) in thickness cemented to the surface of walls or ceilings if these materials have a flame-spread characteristic no greater than paper of this thickness cemented to a noncombustible backing.

**5315.2 Smoke-developed index.** Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.

**5315.3 Testing.** Tests shall be made in accordance with ASTM E 84.

**5315.4 Alternate test method.** As an alternate to having a flame-spread classification of not greater than 200 and a smoke developed index of not greater than 450 when tested in accordance with ASTM E 84, wall and ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:

During the 40 kW exposure, the interior finish shall comply with Item 1. During the 160 kW exposure, the interior finish shall comply with Item 2. During the entire test, the interior finish shall comply with Item 3.

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. During the 160 kW exposure, the interior finish shall comply with the following:

- 2.1. Flame shall not spread to the outer extremity of the sample on any wall or ceiling.
- 2.2. Flashover, as defined in NFPA 286, shall not occur.
3. The total smoke released throughout the NFPA 286 test shall not exceed 1,000 m<sup>2</sup>.

## SECTION 5316 INSULATION

*(also see Chapter 61 as such relates to energy conservation requirements)*

**5316.1 Insulation.** Insulation materials, including facings, such as vapor retarders or vapor permeable membranes installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and attics shall have a flame-spread index not to exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E 84.

### Exceptions:

1. When such materials are installed in concealed spaces, the flame-spread and smoke-developed limitations do not apply to the facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
2. Cellulose loose-fill insulation, which is not spray applied, complying with the requirements of Section 5316.3, shall only be required to meet the smoke-developed index of not more than 450.

**5316.2 Loose-fill insulation.** Loose-fill insulation materials that cannot be mounted in the ASTM E 84 apparatus without a screen or artificial supports shall have a flame-spread rating not to exceed 25 with an accompanying smoke-developed factor not to exceed 450 when tested in accordance with CAN/ULC-S102.2.

**Exception:** Cellulose loose-fill insulation shall not be required to comply with this test method provided that such insulation complies with the requirements of Section 5316.3.

**5316.3 Cellulose loose-fill insulation.** Cellulose loose-fill insulation shall comply with CPSC 16 CFR, Parts 1209 and 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR, Parts 1209 and 1404.

**5316.4 Exposed attic insulation.** All exposed insulation materials installed on attic floors shall have a critical radiant flux not less than 0.12 watt per square centimeter.

**5316.5 Testing.** Tests for critical radiant flux shall be made in accordance with ASTM E 970.

## SECTION 5317 DWELLING UNIT SEPARATION

**5317.1 Two-family dwellings.** Dwelling units in two-family dwellings shall be separated from each other by wall and/or floor assemblies having not less than 1-hour fire-resistance rating

when tested in accordance with ASTM E 119. Fire-resistance-rated floor-ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend to the underside of the roof sheathing.

**Exception:** A fire resistance rating of 1/2 hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.

**5317.1.1 Supporting construction.** When floor assemblies are required to be fire-resistance-rated by Section 5317.1, the supporting construction of such assemblies shall have an equal or greater fire-resistive rating.

**5317.2 Townhouses.** *For other than one- and two-family dwellings, refer to all applicable construction requirements of the Sixth Edition, Massachusetts State Building Code while utilizing the wind and snow loading of this code.*

**5317.3 Rated penetrations.** Penetrations of wall or floor/ceiling assemblies required to be fire-resistance-rated in accordance with Section 5317.1 or 5317.2 shall be protected in accordance with this section.

**5317.3.1 Through penetrations.** Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section 5317.3.1.1 or 5317.3.1.2.

**Exception:** Where the penetrating items are steel, ferrous or copper pipes or steel conduits, the annular space shall be permitted to be protected as follows:

1. In concrete or masonry wall or floor assemblies where the penetrating item is a maximum 6 inches (152 mm) nominal diameter and the opening is a maximum 144 square inches (92 900 mm<sup>2</sup>), concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating.
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time temperature fire conditions under a minimum positive pressure differential of 0.01 inch of water (3 Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

**5317.3.1.1 Fire-resistance-rated assembly.** Penetrations shall be installed as tested in the approved fire-resistance-rated assembly.

**5317.3.1.2 Penetration firestop system.** Penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (3 Pa) and shall have an F rating of not less than the required fire-resistance rating of the wall or floor/ceiling assembly penetrated.

**5317.3.2 Membrane penetrations.** Membrane penetrations shall comply with Section 5317.3.1. Where walls are required to have a minimum 1-hour fire resistance rating,



recessed light fixtures shall be so installed such that the required fire resistance will not be reduced.

**Exceptions:**

1. Steel electrical boxes that do not exceed 16 square inches (0.0103m<sup>2</sup>) in area provided the total area of such openings does not exceed 100 square inches (0.0645 m<sup>2</sup> for any 100 square feet (9.29 m<sup>2</sup>) of wall area. Outlet boxes on opposite sides of the wall shall be separated as follows:
  - 1.1. By a horizontal distance of not less than 24 inches (610 mm);
  - 1.2. By a horizontal distance of not less than the depth of the wall cavity when the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation;
  - 1.3. By solid fire blocking in accordance with Section 5602.8.1;
  - 1.4. By protecting both outlet boxes by listed putty pads; or
  - 1.5. By other listed materials and methods.
2. Membrane penetrations for listed electrical outlet boxes of any materials are permitted provided such boxes have been tested for use in fire resistance-rated assemblies and are installed in accordance with the instructions included in the listing. Outlet boxes on opposite sides of the wall shall be separated as follows:
  - 2.1. By a horizontal distance of not less than 24 inches (610 mm);
  - 2.2. By solid fire-blocking in accordance with Section 5602.8;
  - 2.3. By protecting both outlet boxes by listed putty pads; or
  - 2.4. By other listed materials and methods.
3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate.

## SECTION 5318 MOISTURE VAPOR RETARDERS

**5318.1 Moisture control.** In all framed walls, floors and roof/ceilings comprising elements of the building thermal envelope, a vapor retarder shall be installed on the warm-in-winter side of the insulation.

**Exceptions:**

1. *See the vapor retarder requirements of Chapter 61 of this code.*
2. Where the framed cavity or space is ventilated to allow moisture to escape.

## SECTION 5319 PROTECTION AGAINST DECAY

**5319.1 Location required.** *The* following locations shall require the use of an approved species and grade of lumber, pressure treated in accordance with AWPAC1, C2, C3, C4, C9, C15, C18, C22, C23, C24, C28, C31, C33, P1, P2 and P3, or decay-resistant heartwood of redwood, black locust, or cedars.

1. Wood joists or the bottom of a wood structural floor when closer than 18 inches (457 mm) or wood girders when closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated area located within the periphery of the building foundation.
2. All wood framing members that rest on concrete or masonry exterior foundation walls and are less than 8 inches (203 mm) from the exposed ground.
3. Sills and sleepers on a concrete or masonry slab that is in direct contact with the ground unless separated from such slab by an impervious moisture barrier.
4. The ends of wood girders entering exterior masonry or concrete walls having clearances of less than 0.5 inch (12.7 mm) on tops, sides and ends.
5. Wood siding, sheathing and wall framing on the exterior of a building having a clearance of less than 6 inches (152 mm) from the ground.
6. Wood structural members supporting moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, unless separated from such floors or roofs by an impervious moisture barrier.
7. Wood furring strips or other wood framing members attached directly to the interior of exterior masonry walls or concrete walls below grade except where an approved vapor retarder is applied between the wall and the furring strips or framing members.

**5319.1.1 Ground contact.** All wood in contact with the ground and that supports permanent structures intended for human occupancy shall be approved pressure preservative treated wood suitable for ground contact use, except untreated wood may be used where entirely below ground-water level or continuously submerged in fresh water.

**5319.1.2 Geographical areas.** In geographical areas where experience has demonstrated a specific need, approved naturally durable or pressure preservative treated wood shall be used for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances when such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering that would prevent moisture or water accumulation on the surface or at joints between members. Depending on local experience, such members may include:

1. Horizontal members such as girders, joists and decking.
2. Vertical members such as posts, poles and columns.
3. Both horizontal and vertical members.

**5319.1.3 Posts, poles and columns.** Posts, poles and columns supporting permanent structures that are embedded in concrete in direct contact with the ground or embedded in concrete exposed to the weather shall be approved pressure preservatively treated wood suitable for ground contact use.

**5319.1.4 Wood columns.** Wood columns shall be approved wood of natural decay resistance or approved pressure preservatively treated wood.

**Exceptions:**

1. Posts or columns which are either exposed to the weather or located in basements or cellars, supported by piers or metal pedestals projecting 1 inch (25.4 mm) above the floor or finished grade and 6 inches (152 mm) above exposed earth, and are separated there from by an approved impervious moisture barrier.
2. Posts or columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building, supported by a concrete pier or metal pedestal at a height greater than 8 inches (203mm) from exposed ground, are separated there from by an impervious moisture barrier.

**5319.2 Quality mark.** Lumber and plywood required to be pressure preservatively treated in accordance with Section 5319.1 shall bear the quality mark of an approved inspection agency that maintains continuing supervision, testing and inspection over the quality of the product and that has been approved by an accreditation body that complies with the requirements of the American Lumber Standard Committee treated wood program.

**5319.2.1 Required information.** The required quality mark on each piece of pressure preservatively treated lumber or plywood shall contain the following information:

1. Identification of the treating plant.
2. Type of preservative.
3. The minimum preservative retention.
4. End use for which the product was treated.
5. Standard to which the product was treated.
6. Identity of the approved inspection agency.
7. The designation "Dry," if applicable.

**Exception:** Quality marks on lumber less than 1 inch (25.4 mm) nominal thickness, or lumber less than nominal 1 inch by 5 inches (25.4 mm by 127 mm) or 2 inches by 4 inches (51 mm by 102 mm) or lumber 36 inches (914 mm) or less in length shall be applied by stamping the faces of exterior pieces or by end labeling not less than 25 percent of the pieces of a bundled unit.

**5319.3 Fasteners.** Fasteners for pressure preservative and fire-retardant-treated wood shall be of hot-dipped galvanized steel, stainless steel, silicon bronze or copper *but such fasteners must be acceptable for the chemical preservatives utilized.*

## SECTION 5320 PROTECTION AGAINST TERMITES

**5320.1 Subterranean termite control.** In areas favorable to termite damage as established by Table 5301.2(1), methods of protection shall be by chemical soil treatment, pressure preservatively treated wood in accordance with the AWP standards listed in Section 5319.1, naturally termite-resistant wood or physical barriers (such as metal or plastic termite shields), or any combination of these methods. *All chemicals and chemical treatment and disposal methods shall conform to all governing laws and regulations.*

**5320.1.1 Quality mark.** Lumber and plywood required to be pressure preservatively treated in accordance with Section 5320.1 shall bear the quality mark of an approved inspection agency which maintains continuing supervision, testing and inspection over the quality of the product and which has been approved by an accreditation body which complies with the requirements of the American Lumber Standard Committee treated wood program.

**5320.2 Chemical soil treatment.** The concentration, rate of application and treatment method of the termiticide shall be consistent with and never less than the termiticide label.

**5320.3 Pressure preservatively treated and naturally resistant wood.** Heartwood of redwood and eastern red cedar shall be considered termite resistant. Pressure preservatively treated wood and naturally termite-resistant wood shall not be used as a physical barrier unless a barrier can be inspected for any termite shelter tubes around the inside and outside edges and joints of a barrier.

**5320.3.1 Field treatment.** Field cut ends, notches and drilled holes of pressure preservatively treated wood shall be retreated in the field in accordance with AWP M4.

**5320.4 Foam plastic protection.** In areas where the probability of termite infestation is "very heavy" as indicated in Figure 5301.2(6), extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be at least 6 inches (152 mm).

**Exceptions:**

1. Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure preservatively treated wood.
2. When in addition to the requirements of 5320.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
3. On the interior side of basement walls.

## SECTION 5321 SITE ADDRESS

**5321.1 Premises identification.** *See MGL c.148 § 59, enforced by the head of the fire department.*

## SECTION 5322 ACCESSIBILITY

**5322.1 Scope.** Refer to Section 5311.6, inclusive, of this code.

## SECTION 5323 FLOOD-RESISTANT CONSTRUCTION

**5323.1 General.** Buildings and structures constructed in flood hazard areas (including A or V Zones) as established by *FEMA Flood Insurance Rate Maps* shall be designed and constructed in accordance with the provisions contained in this section.

**5323.1.1 Structural systems.** All structural systems of all buildings and structures shall be designed, connected and anchored to resist flotation, collapse or permanent lateral movement due to structural loads and stresses from flooding equal to the design flood elevation.

**5323.1.2 Flood-resistant construction.** All buildings and structures erected in areas prone to flooding shall be constructed by methods and practices that minimize flood damage.

**5323.1.3 Establishing the design flood elevation.** The design flood elevation shall be used to define areas prone to flooding, and shall describe, at a minimum, the base flood elevation at the depth of peak elevation of flooding (including wave height) which has a 1 percent (100-year flood) or greater chance of being equaled or exceeded in any given year.

**5323.1.4 Lowest floor.** The lowest floor shall be the floor of the lowest enclosed area, including basement, but excluding any unfinished flood-resistant enclosure that is useable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the building or structure in violation of this section.

**5323.1.5 Protection of mechanical and electrical systems.** Electrical systems, equipment and components, and heating, ventilating, air conditioning and plumbing appliances, plumbing fixtures, duct systems, and other service equipment shall be located at or above the design flood elevation. If replaced as part of a substantial improvement, electrical systems, equipment and components, and heating, ventilating, air conditioning, and plumbing appliances, plumbing fixtures, duct systems, and other service equipment shall meet the requirements of this section. Systems, fixtures, and equipment and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

**Exception:** Via engineered design and proper construction execution of the design, electrical systems, equipment and components, and heating, ventilating, air conditioning and plumbing appliances, plumbing fixtures, duct systems, and other service equipment are permitted to be located below the design flood elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in compliance with the flood-resistant construction require-

ments of *this section, as applicable*. Electrical wiring systems are permitted to be located below the design flood elevation provided they conform to the provisions of *the Massachusetts Electrical Code, 527 CMR 12*.

**5323.1.6 Protection of water supply and sanitary sewage systems.** New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the systems in accordance with the plumbing provisions of *248 CMR*. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into systems and discharges from systems into floodwaters in accordance with *the applicable provisions of 248 CMR or Title 5 of the State Sanitary Code, 310 CMR 15.000 et seq.*

**5323.1.7 Flood-resistant materials.** Building materials used below the design flood elevation shall comply with the following:

1. All wood, including floor sheathing, shall be pressure preservatively treated in accordance with AWPAC1, C2, C3, C4, C9, C15, C18, C22, C23, C24, C28, P1, P2 and P3 or decay-resistant heartwood or redwood, black locust, or cedars.
2. Materials and installation methods used for flooring and interior and exterior walls and wall coverings shall conform to the provisions of FEMA/FIA-TB-2.

**5323.1.8 Manufactured housing.** New or replacement manufactured housing shall be elevated in accordance with Section 5323.2 and the anchor and tie-down requirements of Sections AE604 and AE605 of Appendix E shall apply. The foundation and anchorage of manufactured housing to be located in identified flood ways as established in Table 5301.2(1) shall be designed and constructed in accordance with the applicable provisions in the International Building Code.

**5323.1.9 As-built elevation documentation.** A registered design professional shall prepare and seal documentation of the elevations specified in Section 5323.2 or 5323.3.

**5323.2 Flood hazard areas (including A Zones).** All areas that have been determined to be prone to flooding but not subject to high velocity wave action shall be designated as flood hazard areas. All buildings and structures erected in flood hazard areas shall be designed and constructed in accordance with Sections 5323.2.1 through 5323.2.3.

### 5323.2.1 Elevation requirements.

1. Buildings and structures shall have the lowest floors elevated to or above the design flood elevation.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated at least as high above the highest adjacent grade as the depth number specified in feet (mm) on the FIRM, or at least 2 feet (610 mm) if a depth number is not specified.
3. Basement floors that are below grade on all sides shall be elevated to or above the design flood elevation.

**Exception:** Enclosed areas below the design flood elevation, including basements whose floors are not below

grade on all sides, shall meet the requirements of Section 5323.2.2.

**5323.2.2 Enclosed area below design flood elevation.** Enclosed areas, including crawl spaces, that are below the design flood elevation shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings which shall meet the following criteria:
  - 2.1. There shall be a minimum of two openings on different sides of each enclosed area; if a building has more than one enclosed area below the design flood elevation, each area shall have openings on exterior walls.
  - 2.2. The total net area of all openings shall be at least 1 square inch for each square foot (275 mm for each square meter) of enclosed area.
  - 2.3. The bottom of each opening shall be 1 foot (305 mm) or less above the adjacent ground-level.
  - 2.4. Openings shall be at least 3 inches (76 mm) in diameter.
  - 2.5. Any louvers, screens or other opening covers shall allow the automatic flow of floodwaters into and out of the enclosed area.
  - 2.6. Openings installed in doors and windows, that meet requirements 2.1 through 2.5, are acceptable; however, doors and windows without installed openings do not meet the requirements of this section.

**5323.2.3 Foundation design and construction.** Foundation walls for all buildings and structures erected in flood hazard areas shall meet the requirements of Chapter 54.

**Exception:** Unless designed in accordance with Section 5404:

1. The unsupported height of 6 inches (152 mm) plain masonry walls shall be no greater than 3 feet (914 mm).
2. The unsupported height of 8 inches (203 mm) plain masonry walls shall be no greater than 4 feet (1219 mm).
3. The unsupported height of 8 inches (203 mm) rein-forced masonry walls shall be no greater than 8 feet (2438 mm).

For the purpose of this exception, unsupported height is the distance from the finished grade of the under-floor space and the top of the wall.

**5323.3 Coastal high-hazard areas (including V Zones).** Areas that have been determined to be subject to wave heights in excess of 3 feet (914 mm) or subject to high velocity wave action or wave-induced erosion shall be designated as coastal high-hazard areas. All buildings and structures erected in

coastal high-hazard areas shall be designed and constructed in accordance with Sections 5323.3.1 through 5323.3.6.

*Exception: A proposed addition that triggers the substantial improvement requirements (see Section 5302, Definitions, of this code) shall be constructed to the requirements of this section; however, the existing structure is not required to be brought into compliance with this section, provided that the addition is not an additional story(s) which relies on the support of the existing structure.*

*Should the work involved in constructing the additional story(s) meet the "Substantial improvement" definition, the existing structure shall then be required to meet all of the applicable provisions of this section.*

#### **5323.3.1 Location and site preparation.**

1. Buildings and structures shall be located landward of the reach of mean high tide.
2. For any alteration of sand dunes the building official shall require submission of an engineering analysis which demonstrates that the proposed alteration will not increase the potential for flood damage.

#### **5323.3.2 Elevation requirements.**

1. All buildings and structures erected within coastal high hazard areas shall be elevated so that the lowest portion of all structural members supporting the lowest floor, with the exception of mat or raft foundations, piling, pile caps, columns, grade beams and bracing, is located at or above the design flood elevation.
2. Basement floors that are below grade on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. The placement of fill beneath buildings and structures is prohibited.

**Exception:** Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections 5323.3.4 and 5323.3.5.

**5323.3.3 Foundations.** All buildings and structures erected in coastal high hazard areas shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns. Piling shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile systems design and installation shall be certified in accordance with Section 5323.3.6. Mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section 5401.4 indicate that soil material under the mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions.

**5323.3.3.1 Repair or replacement of existing foundations.** Existing foundations may be repaired without further compliance with this section (5323.3 inclusive and as applicable) unless the work required is determined to be substantial as defined in herein.

*Exception: Existing foundation systems which are replaced in total or which are replaced so as to constitute new construction shall meet the requirements of this section (5323.3 inclusive and as applicable) regardless of whether the work required is substantial.*

**5323.3.4 Walls below design flood elevation.** Walls and partitions are permitted below the elevated floor, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical, and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads, and
2. Are constructed with insect screening or open lattice, or;
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a design safe loading resistance of not less than 10 (0.48 kN/m<sup>2</sup>) and no more than 20 pounds per square foot (0.96 kN/m<sup>2</sup>); or
4. Where wind loading values of this code exceed 20 pounds per square foot (0.96 kN/m<sup>2</sup>), the construction documents shall include documentation prepared and sealed by a registered design professional that:
  - 4.1. The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the design flood.
  - 4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructural). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code.

**5323.3.5 Enclosed areas below design flood elevation.** Enclosed areas below the design flood elevation shall be used solely for parking of vehicles, building access or storage.

**5323.3.6 Construction documents.** The construction documents shall include documentation that is prepared and sealed by a *Massachusetts*-registered *architect or professional engineer* that the design and methods of construction to be used meet the applicable criteria of this section.

